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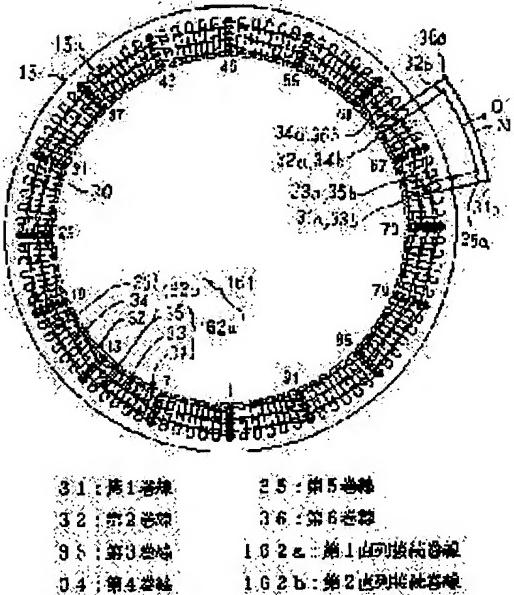
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## (54) ROTATING ELECTRIC MACHINE

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To obtain a rotating electric machine which enables dimension reduction and output increase as well as high productivity.

**SOLUTION:** A stator winding 16 has 1st to 6th windings 31 to 36 wound in the forms of single-turn wave winding. A 1st series connected winding 162a is composed of the 1st, 3rd and 5th windings, 31, 33 and 35 connected in series to each other. A 2nd series connected winding 162b consists of the 2nd, 4th and 6th windings 32, 34 and 36, which are connected in series with each other. The 1st and 2nd series connected windings 162a and 162b are connected in parallel to each other to form stator winding groups 161 of respective phases.



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## CLAIMS

## [Claim(s)]

[Claim 1] In the rotation electrical machinery equipped with the armature which has the armature core by which two or more slots prolonged in shaft orientations were prepared in the hoop direction, and the armature winding around which the above-mentioned slot of this armature core was looped. The 1st wave volume coil group which comes to arrange the above-mentioned armature winding by the number as the above-mentioned number of predetermined slots with the 1st coil of 1 turn constituted by looping around wavelike so that might be taken a strand in the slot depth direction within a slot and a inner layer and an outer layer might be taken by turns for every number of predetermined slots same at one slot pitch, For every above-mentioned number of predetermined slots so that may be taken the above-mentioned strand in the slot depth direction within the above-mentioned slot and a inner layer and an outer layer may be taken by turns wavelike And the 2nd wave volume coil group which comes to arrange the 2nd coil of 1 turn constituted by looping around so that it might shift 180 degrees and might be reversed by the electrical angle to the 1st coil of the above by one slot pitch by the same number as the above-mentioned number of predetermined slots The slot stowage grade of the 1st coil of the above, and the slot stowage grade of the 2nd coil of the above in the slot depth direction in each above-mentioned slot by turns n pair (n : natural number) arrangement is carried out, and it is constituted so that it may rank with one train. and each phase of the above-mentioned armature winding Rotation electrical machinery characterized by the thing which it consisted of by connecting at a time to a serial n the 2n above 1st and the 2nd coil around which the same slot group which consists of slots for every above-mentioned number of predetermined slots is looped, and which the series-connection coil of two n turns is connected in parallel, and is constituted.

[Claim 2] The two above-mentioned series-connection coils are rotation electrical machinery according to claim 1 characterized by consisting of a 1st series-connection coil of n turn constituted by connecting in series the 1st n coils of the above around which the same above-mentioned slot group is looped, and a 2nd series-connection coil of n turn constituted by connecting in series the 2nd n coils of the above around which the same above-mentioned slot group is looped.

[Claim 3] Rotation electrical machinery according to claim 1 or 2 characterized by Above n being  $2m+1$  (m : natural number).

[Claim 4] the above-mentioned strand -- the conductor of the letter of the abbreviation for U characters -- a segment -- it is -- the above of plurality [ coil / 2nd / the above 1st and ] respectively -- a conductor -- rotation electrical machinery given in any of the claim 1 characterized by joining the open ends of a segment and being constituted by the wave volume coil of 1 turn, or a claim 3 they are

[Claim 5] the above-mentioned strand -- continuation -- a conductor -- a line -- it is -- the above 1st and the 2nd coil -- respectively -- the above-mentioned continuation of one -- a conductor -- rotation electrical machinery given in any of the claim 1 characterized by lines being consisted of by the wave volume coil of 1 turn, or a claim 3 they are

[Claim 6] the [ the above 1st and ] -- the rotation electrical machinery according to claim 5 characterized by each set of 2 wave volume coil group consisting of coil assemblies which gathered two or more above 1st and the 2nd coil, respectively

[Claim 7] The above-mentioned strand is rotation electrical machinery according to claim 1 to 6 characterized by being the conductor which has an approximate circle form cross section.

[Claim 8] Rotation electrical machinery given in any of the claim 1 characterized by connecting the two above-mentioned series-connection coils which constitute each phase of the above-mentioned armature winding through a metal terminal, or a claim 7 they are.

[Claim 9] Rotation electrical machinery given in any of the claim 1 or claim 8 which is equipped with the following and characterized by making it a cooling wind ventilated by the coil and the section of the above-mentioned armature winding by rotation of the above-mentioned fan they are. The above-mentioned armature core is a rotator which forms

NS pole along with the rotation hoop direction which is the stator core of the shape of a cylinder which consists of a layer-built iron core, and was arranged in the interior of the above-mentioned stator core by the same axle. The fan who fixed at the shaft-orientations edge of the above-mentioned rotator.

[Claim 10] n pairs of the above-mentioned 1st wave volume coil group and the above-mentioned 2nd wave volume coil group are rotation electrical machinery according to claim 9 characterized by the shaft-orientations extension height from the above-mentioned stator core being low gradually toward the method of the outside of the direction of a path.

[Claim 11] In the rotation electrical machinery equipped with the armature which has the armature core by which two or more slots prolonged in shaft orientations were prepared in the hoop direction, and the armature winding around which the above-mentioned slot of this armature core was looped. The above-mentioned slot has been equivalent to every \*\*\*\* enough, and is formed in the above-mentioned armature core two pieces. the above-mentioned armature winding It consists of 2 sets of line windings which come to connect the coil of each phase a star type. the coil of each above-mentioned phase  $2n$  ( $n$  : natural number) array of the strand is carried out in the slot depth direction at each of the above-mentioned slot. And connect in parallel 2 sets of  $n$  turn coils looped around and constituted so that the layers from which the slot depth direction of number remote of predetermined slots each slot pair in the outside of a slot differs might be connected, and it is constituted. Furthermore, rotation electrical machinery characterized by being constituted so that it may be compounded and outputted, after the ac output of the 2 above-mentioned sets of line windings is rectified independently by the 1st and 2nd rectifiers, respectively.

[Claim 12] Rotation electrical machinery according to claim 11 characterized by being formed so that the coil and the section of the above-mentioned strand which connect the layers of the above-mentioned armature core from which the slot depth direction of number remote of predetermined slots each slot pair differs in an end side at least may be located in a line with  $n$  train in the direction of a path, and the above-mentioned coil of  $n$  train and the shaft-orientations height of the section being low gradually toward the method of the outside of the direction of a path.

[Claim 13] Rotation electrical machinery according to claim 11 characterized by being formed so that the coil and the section of the above-mentioned strand which connect the layers of the above-mentioned armature core from which the slot depth direction of number remote of predetermined slots each slot pair differs in an end side at least may be located in a line with  $n$  train in the direction of a path, and the above-mentioned coil and the section of  $n$  train being arranged by the hoop direction at abbreviation homogeneity.

[Claim 14] Rotation electrical machinery according to claim 11 characterized by being formed so that the coil and the section of the above-mentioned strand which connect the layers of the above-mentioned armature core from which the slot depth direction of number remote of predetermined slots each slot pair differs in an end side at least may be located in a line with shaft orientations in layers at  $n$  layers, and the above-mentioned coil of  $n$  layers and the section being arranged by the hoop direction at abbreviation homogeneity.

[Claim 15] the above-mentioned strand -- the conductor of the letter of the abbreviation for U characters -- the rotation electrical machinery according to claim 11 to 14 by which it is characterized [ which consists of segments ]

[Claim 16] the above-mentioned strand -- continuation -- a conductor -- the rotation electrical machinery according to claim 11 to 14 characterized by consisting of lines

[Claim 17] Rotation electrical machinery according to claim 11 to 16 characterized by making the insulating resin intervene among 2 sets of the above-mentioned armature core which constitutes the coil of each above-mentioned phase in an end side at least of above-mentioned  $n$  turn coils.

[Translation done.]

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## DETAILED DESCRIPTION

## [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] Especially this invention relates to the stator winding structure of the AC generator for vehicles which can be carried in the AC generator driven with an internal combustion engine, for example, a passenger car, a truck, etc. about the armature-winding structure of rotation electrical machinery.

[0002]

[Description of the Prior Art] In recent years, in an AC generator, improvement in small high power and quality has been called for increasingly. In order to realize small high power, it becomes important how distribution with magnetic loading and electric loading are constituted [ how ] with high density in the limited capacity the optimal. For example, in the AC generator for vehicles, while a vehicles engine room narrow-izes increasingly and a margin is being lost to a loading space, improvement in the power generation output by increase of a vehicles load is called for. Moreover, although the needs of a noise reduction are high both in the car outsides and the engine noise has been falling, let noise of the AC generator for vehicles which always carries out power generation operation and is for electric-load supply on vehicles be a problem. Furthermore, since the AC generator for vehicles is always carrying out power generation operation, for the Joule's heat of the output current, there is much the calorific value, the thermal environment \*\*(ed) is severe and very high thermal resistance is called for.

[0003] It is necessary to meet further the demand of reduction of the wirewound-resistor value of a stator winding, improvement in the space factor of the electric conductor dedicated in the magnetic circuit of a stator, the low noise with alignment-izing and densification of the passage section (the passage section besides a stator core is called coil end) of a stator winding above required, heat-resistant environment nature, etc. especially about the small high power of an AC generator. and the electric conductor of a stator winding -- a short length conductor with the large cross section -- the structure of attaining reduction of a wirewound-resistor value (heat loss), improvement in a space factor of an electric conductor or alignment-izing of a coil end, and densification is proposed by WO 92/No. 06527 etc. using the segment

[0004] Moreover, in this kind of AC generator, in order to reduce the armature reaction leading to the loss of power in a high-speed rotation region (for example, 2000 - 5000rpm), it is effective to reduce the number of turns of each phase of a stator winding. Although the number of turns can be reduced by specifically reducing the number of electric conductors contained in a slot, the flakiness (the slot-width direction length of the slot depth direction length / cross section of a cross section) of an electric conductor is large, and this means a bird clapper. however, the short length conductor used for an electric conductor -- the moldability of the turn section will get worse, so that flakiness becomes large, since incurvation fabrication of the segment is carried out in the conductor which has a straight angle cross section at the letter of the abbreviation for U characters Then, the number of electric conductors contained in a slot is made [ many ], flakiness of an electric conductor is made small, aggravation of the moldability of the turn section is suppressed, parallel connection of the coil which connected the electric conductor further and was formed is carried out, and it becomes effective to reduce the number of turns of each phase of a stator winding.

[0005] a short length conductor -- what carried out parallel connection of the coil of a lap winding (loop volume) and the coil of a wave volume, and constituted the coil of each phase of a stator winding is indicated by JP,2000-92766,A using the segment this conventional stator winding is shown in drawing 19 -- as -- a straight angle -- three kinds of conductors by which incurvation fabrication was carried out in the conductor at the letter of the abbreviation for U characters -- segments 311, 312, and 313 are used and a conductor -- segments 311, 312, and 313 are inserted in the slot of each class which separated 3 slots (1 pole pitch) from the end side of the shaft orientations of a stator core, join the edges which extend to the other end side of the shaft orientations of a stator core by welding etc., and are formed in the coil which carries out the surroundings of a stator core 4 round in addition -- the inside of each slot -- a conductor --

six conductors which constitute each slot stowages 311a, 312a, and 313a of segments 311, 312, and 313 are arranged by the single tier about the direction of a path of a stator core here -- the conductor within a slot -- a position is called 2nd ... 1st street [ 6th ] from an inner circumference side moreover, the end side of the shaft orientations of a stator core -- setting -- a conductor -- turn section 312b of a segment 312 -- a conductor -- turn section 313b of a segment 313 -- surrounding -- a conductor -- turn section 311b of a segment 311 -- a conductor -- turn section 312b of a segment 312 is surrounded and the conductor which extends from the 3rd street of one slot to the other end side of the shaft orientations of a stator core -- the conductor to which edge 313c of a segment 313 extends from the 4th street of a slot besides 3 slot remote -- it is joined to edge 313c of a segment 313, and two coils 301 and 303 of the wave winding of 1 turn are formed per slot It is joined to edge 312c of a segment 312. moreover, the conductor which extends from the 1st street of one slot -- the conductor to which edge 311c of a segment 311 extends from the 2nd street, a slot besides 3 slot remote, -- It is joined to edge 311c of a segment 311. the conductor which extends from the 5th street of one more slot -- the conductor to which edge 312c of a segment 312 extends from the 6th street of a slot besides 3 slot remote -- Two coils 302 and 304 of the lap winding of 2 turns are formed per slot.

[0006] And as shown in drawing 20, the stator winding of each phase 6 turn consists of connecting the coils 301 and 303 of two wave volumes, and the coils 302 and 304 of two lap windings in series. Moreover, as shown in drawing 21, the coil 301 of a wave volume and the coil 302 of a lap winding are connected in series, the coil 303 of a wave winding and the coil 304 of a lap winding are connected in series, both are connected in parallel, and the stator winding group of each phase 3 turn is constituted. The stator winding to which alternating current connection is carried out and which these stator winding groups become from 1 set of three-phase-circuit line windings is constituted. This stator winding is connected to the rectifier.

[0007]

[Problem(s) to be Solved by the Invention] the stator winding of this conventional AC generator for vehicles -- three kinds of conductors large minor as mentioned above -- segments 311, 312, and 313 were inserted so that the turn sections 311a, 312a, and 313a might be accumulated on the slot of 1 pole-pitch remote each class from the end side of a stator core, and the edges which extend to the other end side of a stator core were joined, and it was constituted Then, while being unable to attain a miniaturization since the height of the coil end of the stator winding by the side of the end of a stator core 15 became high as shown in drawing 22, the wirewound-resistor value rose, heat loss became large, and the calorific value in a coil increased, and the leakage reactance of a coil end increased, and the technical problem that a high increase in power was not attained occurred. Moreover, since turn section 313a is covered by turn section 312a and turn section 312a is covered by turn section 311a, the exposure surface area of the coil end of the stator winding by the side of the end of a stator core 15 is reduced, and a stator winding is no longer cooled efficiently. Consequently, the temperature of a stator winding became an elevated temperature and the technical problem that a high increase in power was not attained also occurred. Furthermore, it has been equivalent to every \*\*\* enough, and since the stator core which has the one number of slots is looped around 1 set of three-phase-circuit line windings and the output is rectified by 1 set of rectifiers, there are few numbers with which the turn section which extends from each slot aligns in a coil end at a hoop direction, and cooling nature is bad. Thereby, the temperature of a stator winding became an elevated temperature and the technical problem that a high increase in power was not attained occurred. Moreover, since only 1 set was equipped also with the rectifier, the loss per rectifier diode became large, it became an elevated temperature, and a high increase in power was difficult.

[0008] The 1st wave volume coil group by which this invention was constituted from the 1st coil of the wave volume of 1 turn per slot in view of the technical problem of the above Prior arts, n pairs of 2nd wave volume coil groups which consisted of the 2nd coil of the wave volume of 1 turn per [ by which shifted 180 degrees and reversal looping around was carried out by the electrical angle to this 1st coil ] slot are looped around. It aims at obtaining the rotation electrical machinery which was constituted by connecting to a serial every n of 2n coil which consists of the 1st and 2nd coils which constitute each phase and which connected the series-connection coil of two n turns in parallel, and has small, high power, and high productivity. Moreover, the number of slots enough which is equivalent to every \*\*\* is made into two pieces, and a stator winding carries out alternating current connection of the stator winding group of each phase, and it constitutes from 2 sets of line windings, and is made to carry out independent rectification of the line winding of each class, and the cooling nature of the coil end of a stator winding is raised, and loss of rectifier diode is reduced, and it aims at obtaining the rotation electrical machinery which can realize high power.

[0009]

[Means for Solving the Problem] In the rotation electrical machinery equipped with the armature which has the armature core by which two or more slots to which the rotation electrical machinery concerning this invention extends in shaft orientations were prepared in the hoop direction, and the armature winding around which the above-mentioned slot of this armature core was looped The 1st wave volume coil group which comes to arrange the above-mentioned

armature winding by the number as the above-mentioned number of predetermined slots with the 1st coil of 1 turn constituted by looping around wavelike so that might be taken a strand in the slot depth direction within a slot and a inner layer and an outer layer might be taken by turns for every number of predetermined slots same at one slot pitch, For every above-mentioned number of predetermined slots so that may be taken the above-mentioned strand in the slot depth direction within the above-mentioned slot and a inner layer and an outer layer may be taken by turns wavelike And the 2nd wave volume coil group which comes to arrange the 2nd coil of 1 turn constituted by looping around so that it might shift 180 degrees and might be reversed by the electrical angle to the 1st coil of the above by one slot pitch by the same number as the above-mentioned number of predetermined slots The slot stowage grade of the 1st coil of the above, and the slot stowage grade of the 2nd coil of the above in the slot depth direction in each above-mentioned slot by turns n pair (n : natural number) arrangement is carried out, and it is constituted so that it may rank with one train. and each phase of the above-mentioned armature winding It is the thing which connected at a time to the serial n the 2n above 1st and the 2nd coil around which the same slot group which consists of slots for every above-mentioned number of predetermined slots is looped, and was constituted and which connects the series-connection coil of two n turns in parallel, and is constituted.

[0010] Moreover, the two above-mentioned series-connection coils consist of a 1st series-connection coil of n turn constituted by connecting in series the 1st n coils of the above around which the same above-mentioned slot group is looped, and a 2nd series-connection coil of n turn constituted by connecting in series the 2nd n coils of the above around which the same above-mentioned slot group is looped.

[0011] Moreover, Above n is  $2m+1$  (m : natural number).

[0012] moreover, the above-mentioned strand -- the conductor of the letter of the abbreviation for U characters -- a segment -- it is -- the above of plurality [ coil / 2nd / the above 1st and ] respectively -- a conductor -- the open ends of a segment are joined and it is constituted by the wave volume coil of 1 turn

[0013] moreover, the above-mentioned strand -- continuation -- a conductor -- a line -- it is -- the above 1st and the 2nd coil -- respectively -- the above-mentioned continuation of one -- a conductor -- lines are consisted of by the wave volume coil of 1 turn

[0014] the [ moreover, / the above 1st and ] -- each set of 2 wave volume coil group consists of coil assemblies which gathered two or more above 1st and the 2nd coil, respectively

[0015] Moreover, the above-mentioned strand is a conductor which has an approximate circle form cross section.

[0016] Moreover, the two above-mentioned series-connection coils which constitute each phase of the above-mentioned armature winding are connected through the metal terminal.

[0017] Moreover, it has the rotator which forms NS pole along with the rotation hoop direction which the above-mentioned armature core is a stator core of the shape of a cylinder which consists of a layer-built iron core, and was arranged in the interior of the above-mentioned stator core by the same axle, and the fan who fixed at the shaft-orientations edge of the above-mentioned rotator, and is made for a cooling wind to be ventilated by the coil and the section of the above-mentioned armature winding by rotation of the above-mentioned fan.

[0018] Moreover, as for n pairs of the above-mentioned 1st wave volume coil group and the above-mentioned 2nd wave volume coil group, the shaft-orientations extension height from the above-mentioned stator core is low gradually toward the method of the outside of the direction of a path.

[0019] Moreover, it sets for the rotation electrical machinery equipped with the armature which has the armature core by which two or more slots prolonged in shaft orientations were prepared in the hoop direction, and the armature winding around which the above-mentioned slot of this armature core was looped. The above-mentioned slot has been equivalent to every \*\*\*\* enough, and is formed in the above-mentioned armature core two pieces. the above-mentioned armature winding It consists of 2 sets of line windings which come to connect the coil of each phase a star type. the coil of each above-mentioned phase 2n (n : natural number) array of the strand is carried out in the slot depth direction at each of the above-mentioned slot. And connect in parallel 2 sets of n turn coils looped around and constituted so that the layers from which the slot depth direction of number remote of predetermined slots each slot pair in the outside of a slot differs might be connected, and it is constituted. Furthermore, after the ac output of the 2 above-mentioned sets of line windings is rectified independently by the 1st and 2nd rectifiers, respectively, it is constituted so that it may be compounded and outputted.

[0020] Moreover, it is formed so that the coil and the section of the above-mentioned strand which connect the layers of the above-mentioned armature core from which the slot depth direction of number remote of predetermined slots each slot pair differs in an end side at least may be located in a line with n train in the direction of a path, and the above-mentioned coil of n train and the shaft-orientations height of the section are low gradually toward the method of the outside of the direction of a path.

[0021] Moreover, it is formed so that the coil and the section of the above-mentioned strand which connect the layers

of the above-mentioned armature core from which the slot depth direction of number remote of predetermined slots each slot pair differs in an end side at least may be located in a line with n train in the direction of a path, and the above-mentioned coil and the section of n train are arranged by the hoop direction at abbreviation homogeneity. [0022] Moreover, it is formed so that the coil and the section of the above-mentioned strand which connect the layers of the above-mentioned armature core from which the slot depth direction of number remote of predetermined slots each slot pair differs in an end side at least may be located in a line with shaft orientations in layers at n layers, and the above-mentioned coil of n layers and the section are arranged by the hoop direction at abbreviation homogeneity. [0023] moreover, the above-mentioned strand -- the conductor of the letter of the abbreviation for U characters -- it consists of segments

[0024] moreover, the above-mentioned strand -- continuation -- a conductor -- it consists of lines

[0025] Moreover, the insulating resin is made to intervene among 2 sets of the above-mentioned armature core which constitutes the coil of each above-mentioned phase in an end side at least of above-mentioned n turn coils.

[0026]

[Embodiments of the Invention] Hereafter, the form of implementation of this invention is explained about drawing. The cross section showing the composition of the AC generator for vehicles which form 1. drawing 1 of operation requires for the form 1 of implementation of this invention, The end view and the perspective diagram showing the stator of the AC generator for vehicles which drawing 2 and drawing 3 require for the form 1 of implementation of this invention, respectively, The rear side edge side view explaining the connection state for one phase of the stator winding in the AC generator for vehicles which drawing 4 requires for the form 1 of implementation of this invention, The circuit diagram of the AC generator for vehicles which drawing 5 requires for the form 1 of implementation of this invention, the perspective diagram showing the metal terminal mounting state of the stator in the AC generator for vehicles which drawing 6 requires for the form 1 of implementation of this invention, The perspective diagram showing the important section of the strand which constitutes the stator winding applied to the AC generator for vehicles which drawing 7 requires for the form 1 of implementation of this invention, Drawing explaining the array of the strand which constitutes the stator winding applied to the AC generator for vehicles which drawing 8 requires for the form 1 of implementation of this invention, Drawing 9 is drawing showing the coil assembly which constitutes the stator winding applied to the AC generator for vehicles concerning the form 1 of implementation of this invention, and (b of (a) of drawing 9) of the end view and drawing 9 is the plan. In addition, lead wire etc. is omitted in drawing 2 and drawing 3. Moreover, the drawing 4 solid line shows rear \*\*\*\*\* , and the dotted line shows the front side coil.

[0027] It sets to drawing 1 , and it is equipped with the AC generator for vehicles free [ rotation ] through a shaft 6 in the case 3 where the run dollar type rotator 7 consisted of the drive side bearing brackets 1 and commutator side bearing brackets 2 made from aluminum, and it fixes to the internal surface of a case 3, and it is constituted so that the periphery side of the rotator 7 which the stator 8 which works as an armature commits as a field may be covered. The shaft 6 is supported by the drive side bearing bracket 1 and the commutator side bearing bracket 2 possible [ rotation ]. A pulley 4 fixes at the end of this shaft 6, and the rotation torque of an engine can be transmitted now to a shaft 6 through a belt (not shown). The slip ring 9 which supplies current to a rotator 7 fixes to the other end of a shaft 6, and it is contained by the brush holder 11 arranged in the case 3 so that the brush 10 of a couple might \*\*\*\* to this slip ring 9. HITOSHIKU 17 by which the regulator 18 which adjusts the size of the alternating voltage produced in the stator 8 was attached in the brush holder 11 is pasted. It connects with a stator 8 electrically and is equipped with the rectifier 12 which rectifies the alternating current produced in the stator 8 to a direct current in the case 3.

[0028] A rotator 7 is formed so that the rotator coil 13 which passes current and generates magnetic flux, and this rotator coil 13 may be covered, and it consists of field cores 20 and 21 of a couple in which a magnetic pole is formed of the magnetic flux generated with the rotator coil 13. The presser-foot-stitch-tongue-like magnetic poles 22 and 23 of eight presser-foot-stitch-tongue configurations protruded on the periphery edge by angular pitches [ hoop direction ], respectively, the field cores 20 and 21 of a couple are iron, they countered so that the presser-foot-stitch-tongue-like magnetic poles 22 and 23 might be engaged, and they have fixed at the shaft 6. Furthermore, the fan 5 has fixed to the ends of the shaft orientations of a rotator 7. moreover, inhalation of air -- Holes 1a and 2a are formed in the end face of the shaft orientations of a drive side bearing bracket 1 and a commutator side bearing bracket 2, and exhaust holes 1b and 2b are countered and formed in the front side of a stator winding 16, the coil of rear \*\*, and the direction outside of a path of Groups 16f and 16r at the periphery both-shoulders section of a drive side bearing bracket 1 and a commutator side bearing bracket 2

[0029] The stator 8 is equipped with the stator core 15 which consists of the layer-built iron core of the shape of a cylinder by which two or more slot 15a prolonged in shaft orientations was formed in the hoop direction in the predetermined pitch, the stator winding 16 around which the stator core 15 was looped, and the insulator 19 with which it is equipped in each slot 15a, and a stator winding 16 and a stator core 15 are insulated electrically as shown in

drawing 2 and drawing 3. And one strand 30 is turned up out of slot 15a by the side of the end face of a stator core 15, and is equipped with two or more coils which the wave volume was carried out and were looped around so that a inner layer and an outer layer might be taken by turns in the slot depth direction within slot 15a to every number of predetermined slots (1 pole pitch) so that a stator winding 16 may be mentioned later. Here, corresponding to the number of magnetic poles of a rotator 7 (16), 96 slot 15a is formed in the stator core 15 at equal intervals so that 2 sets of three-phase-circuit line windings may be held. That is, the number of slots has been equivalent to every \*\*\* enough, and is 2. Moreover, the copper-wire material of the long picture which has the cross section of the rectangle with which the insulating coat 49 was covered is used for a strand 30.

[0030] Below, the coil structure of the stator winding group 161 for one phase is concretely explained with reference to drawing 4. The stator winding group 161 for one phase consists of the 1st or 6th coil 31-36 which consists of one strand 30, respectively. And from No. 1 of the slot number to No. 91, a wave volume is carried out so that the 1st coil 31 may take one strand 30 every six slots and may take an inner circumference side to the inner circumference side in slot 15a to the 1st position (henceforth the 1st street), and the 2nd position (henceforth the 2nd street) by turns, the coil edges are joined, and it is constituted by the wave volume coil of 1 turn. A wave volume is carried out so that the 2nd coil 32 may take a strand 30 and may take the 2nd street [ 1st ] in slot 15a by turns every six slots from No. 1 of the slot number to No. 91, the coil edges are joined, and it is constituted by the wave volume coil of 1 turn. From No. 1 of the slot number to No. 91, a wave volume is carried out so that the 3rd coil 33 may take a strand 30 every six slots and may take an inner circumference side to the inner circumference side in slot 15a to the 3rd position (henceforth the 3rd street), and the 4th position (henceforth the 4th street) by turns, the coil edges are joined, and it is constituted by the wave volume coil of 1 turn. A wave volume is carried out so that the 4th coil 34 may take a strand 30 and may take the 4th street [ 3rd ] in slot 15a by turns every six slots from No. 1 of the slot number to No. 91, the coil edges are joined, and it is constituted by the wave volume coil of 1 turn. From No. 1 of the slot number to No. 91, a wave volume is carried out so that the 5th coil 35 may take a strand 30 every six slots and may take an inner circumference side to the inner circumference side in slot 15a to the 5th position (henceforth the 5th street), and the 6th position (henceforth the 6th street) by turns, the coil edges are joined, and it is constituted by the wave volume coil of 1 turn. A wave volume is carried out so that the 6th coil 36 may take a strand 30 and may take the 6th street [ 5th ] in slot 15a by turns every six slots from No. 1 of the slot number to No. 91, the coil edges are joined, and it is constituted by the wave volume coil of 1 turn. And in each slot 15a, a strand 30 arranges the longitudinal direction of the rectangular section in the direction of a path, and is arranged together with [ six ] one train in the direction of a path.

[0031] Subsequently, the portion of the strand 30 of the 2nd which extends to the end side of a stator core 15, the 4th, and 6th coils 32, 34, and 36 is cut from No. 61 of the slot number, and No. 67, and the portion of the strand 30 of the 1st which extends to the end side of a stator core 15, the 3rd, and 5th coils 31, 33, and 35 is cut from No. 67 of the slot number, and No. 73. And amputation stump 31a of the 1st coil 31 and amputation stump 33b of the 3rd coil 33 are joined, amputation stump 33a of the 3rd coil 33 and amputation stump 35b of the 5th coil 35 are joined, and 1st series-connection coil 162a of 3 turns to which it comes to carry out the series connection of the 1st, the 3rd, and 5th coils 31, 33, and 35 is formed. Similarly, amputation stump 32a of the 2nd coil 32 and amputation stump 34b of the 4th coil 34 are joined, amputation stump 34a of the 4th coil 34 and amputation stump 36b of the 6th coil 36 are joined, and 2nd series-connection coil 162b of 3 turns to which it comes to carry out the series connection of the 2nd, the 4th, and 6th coils 32, 34, and 36 is formed. subsequently, amputation stump 31b of the 1st coil 31 and amputation stump 36a of the 6th coil 36 -- joining -- amputation stump 32b of the 2nd coil 32, and amputation stump 35a of the 5th coil 35 -- joining -- the [ of 3 turns / the 1st and ] -- the stator winding group 161 for one phase to which parallel connection of the 2 series-connection coils 162a and 162b was carried out is constituted In addition, the joint of the amputation stumps 32b and 35a of the joint of the amputation stumps 31b and 36a of the 1st and 6th coils 31 and 36, the 2nd, and 5th coils 32 and 35 serves as the neutral point (N) and lead wire (O), respectively.

[0032] Similarly every one slot 15a looped around a strand 30 is shifted, and the stator winding group 161 for six phases is formed. And as shown in drawing 5, the stator winding group 161 is three-phase-circuit [ every ]-star-type-connected, 2 sets of three-phase-circuit line windings 160 are formed, and the three phase each line winding 160 is connected to the rectifier 12, respectively. It connects in parallel and the dc output of each rectifier 12 is compounded.

[0033] Here, each strand 30 which constitutes the 1st or 6th coil 31-36 extends from one slot 15a to the end-face side of a stator core 15, and the wave volume is looped around it so that it may be turned up and may go into 6 slot remote slot 15a. And every six slots, each strand 30 is looped around so that a inner layer and an outer layer may be taken by turns about the slot depth direction (the direction of a path) within a slot. Moreover, turn section 30a of the strand 30 extended and turned up at the end-face side of a stator core 15 forms a coil and the section. then, turn section 30a mostly formed in the same configuration in the ends of a stator core 15 -- a hoop direction -- and it estranges mutually in the direction of a path, becomes three trains, is tidily arranged by the hoop direction, and a coil and Groups 16f and

16r are formed

[0034] Subsequently, it explains, referring to drawing 4 or drawing 6 about the connection structure of the stator winding 16 using the metal terminal. a phase outgoing-line 51a, b phase outgoing-line 51b, c phase outgoing-line 51c, and the neutral point outgoing line 52 are fabricated by one with the insulating resin 53, and the metal terminal 50 is constituted. And two pieces 51a1 of connection and 51a2 are formed in a phase outgoing-line 51a at one. Moreover, two pieces 51b1 of connection and 51b2 are formed in b phase outgoing-line 51b at one. Furthermore, two pieces 51c1 of connection and 51c2 are formed in c phase outgoing-line 51c at one. Six pieces 52a1 of connection, 52a2, 52b1, 52b2, 52c1, and 52c2 are formed in the neutral point outgoing line 52 further again at one.

[0035] And the amputation stumps 35a and 32b of the 5th which constitutes the stator winding group 161 of a phase, and 2nd coils 35 and 32 are welded to the piece 51a1 of connection, and 51a2, respectively, and the amputation stumps 31b and 36a of the 1st which constitutes the stator winding group 161 of a phase, and 6th coils 31 and 36 are welded to the piece 52a1 of connection, and 52a2, respectively. Moreover, the amputation stumps 35a and 32b of the 5th which constitutes the stator winding group 161 of b phase, and 2nd coils 35 and 32 are welded to the piece 51b1 of connection, and 51b2, respectively, and the amputation stumps 31b and 36a of the 1st which constitutes the stator winding group 161 of b phase, and 6th coils 31 and 36 are welded to the piece 52b1 of connection, and 52b2, respectively. Furthermore, the amputation stumps 35a and 32b of the 5th which constitutes the stator winding group 161 of c phase, and 5th coils 35 and 32 are welded to the piece 51c1 of connection, and 51c2, respectively, and the amputation stumps 31b and 36a of the 1st which constitutes the stator winding group 161 of c phase, and 6th coils 31 and 36 are welded to the piece 52c1 of connection, and 52c2, respectively.

[0036] Thereby, the stator winding group 161 of each phase connects 1st series-connection coil 162a of the 1st, the 3rd, and 5th coils 31, 33, and 35, and 2nd series-connection coil 162b of the 2nd, the 4th, and 6th coils 32, 34, and 36 in parallel, and is constituted. Moreover, the neutral point of the stator winding group 161 of each phase is summarized to the neutral point outgoing line 52, and alternating current connection (star type connection) of the stator winding group 160 of a phase, b phase, and c phase is carried out. And a phase outgoing-line 51a of the metal terminal 50, b phase outgoing-line 51b, c phase outgoing-line 51c, and the neutral point outgoing line 52 are connected to a rectifier 12, and the circuitry shown in drawing 5 is obtained.

[0037] It is here, and it is looped around wavelike so that the 1st or 6th coil 31-36 may take a strand 30 in the slot depth direction at slot 15a for every six slots and may take a inner layer and an outer layer by turns, respectively. And the 2nd, the 4th, and 6th coils 32, 34, and 36 are looped around so that it may shift 180 degrees and may be reversed by the electrical angle to the 1st, the 3rd, and 5th coils 31, 33, and 35, respectively. Then, the stator winding 16 constituted in this way serves as composition equivalent to what put in order three pairs of pairs of the 1st wave volume coil group which consisted of the 1st coil 31, and the 2nd wave volume coil group which consisted of the 2nd coil 32 in the direction of a path, and arranged them in it. the [ this / the 1st and ] -- the pair of 2 wave volume coil group -- continuation of 12 -- a conductor -- it is provided by the coil assembly knit fabricating the strand 30 which consists of a line wavelike

[0038] Hereafter, the structure of the coil assembly is explained, referring to drawing 7 or drawing 9. The perspective diagram showing the important section of the strand which constitutes the stator winding by which drawing 7 is applied to this AC generator for vehicles, drawing explaining the array of the strand which constitutes the stator winding by which drawing 8 is applied to this AC generator for vehicles, and drawing 9 are drawings showing the coil assembly which constitutes the stator winding applied to this AC generator for vehicles, and (b of (a) of drawing 9 ) of the end view and drawing 9 is the plan. One copper successive line in which a strand 30 has the cross section of the rectangle with which the insulating coat 49 was covered is used. This strand 30 is bent and formed in the plane pattern with which bay 30b as slot stowage grade connected by turn section 30a was arranged by six slot pitches (6P) as shown in drawing 7. and adjacent bay 30b -- turn section 30a -- width-of-face (of a strand 30 -- it is shifted by W) As shown in drawing 8, two strands 30 formed in such a pattern are arranged in piles in 6 slot-pitch staggering \*\*\*\*\* 30b, and constitute the strand pair. This strand pair is equivalent to the pair of the 1st and 2nd coils 31 and 32. This strand pair constitutes the coil assembly 39 which shifts one slot pitch at a time, is arranged six pairs, and is shown in drawing 9. And the edge of a strand 30 has extended six [ at a time ] on both sides of the ends of the strand assembly 39. Moreover, turn section 30a aligns in the both-sides section of the coil assembly 39, and is arranged. The stator before connection is obtained by looping three layers around this coil assembly 39 to slot 15a of a stator core 15 in piles. And based on the connection method shown in drawing 4, the edges of each strand 30 are connected and a stator winding 16 is formed.

[0039] Thus, in the constituted AC generator for vehicles, current is supplied to the rotator coil 13 through a brush 10 and the slip ring 9 from a battery (not shown), and magnetic flux is generated. The presser-foot-stitch-tongue-like magnetic pole 22 of one field core 20 is magnetized by N pole, and the presser-foot-stitch-tongue-like magnetic pole

23 of the field core 21 of another side is magnetized by this magnetic flux at the south pole. On the other hand, the rotation torque of an engine is transmitted to a shaft 6 through a belt and a pulley 4, and a rotator 7 rotates. Then, rotating magnetic field are given to a stator winding 16, and electromotive force occurs in a stator winding 16. While the electromotive force of this alternating current is rectified by direct current through a rectifier 12, the size of the output voltage of a rectifier 12 is adjusted by the regulator 18, and is charged by the battery.

[0040] and the inhalation of air in which the open air countered the heat sink of a rectifier 12, and the heat sink 17 of a regulator 18, respectively, and was prepared by rotation of a fan 5 in rear \*\* -- a hole -- it absorbs through 2a, it flows in accordance with the shaft of a shaft 6, and a rectifier 12 and a regulator 18 are cooled, it is bent by the fan 5 in the centrifugal direction after that, the coil of rear \*\* of a stator winding 16 and group 16r are cooled, and it on the other hand -- a front side -- setting -- rotation of a fan 5 -- the open air -- inhalation of air -- shaft orientations absorb from hole 1a, it is bent by the fan 5 in the centrifugal direction after that, the coil and 16f of groups by the side of the front of a stator winding 16 are cooled, and it is discharged outside from exhaust hole 1b

[0041] Thus, according to the form 1 of this operation, a stator winding 16 is equipped with two three-phase-circuit line-winding groups 160, and the three phase each line winding 160 carries out alternating current connection of the three stator winding groups 161, and is constituted. Furthermore, each stator winding group 161 consists of the 1st or 6th coil 31-36. And the 1st coil 31 is looped around wavelike and constituted by the coil of 1 turn so that a strand 30 may be taken by turns [ 2nd by turns / 1st ] in slot 15a every six slots. That is, the 1st coil 31 is constituted by the wave volume coil of 1 turn by which the wave volume was carried out so that might be taken a strand 30 in the slot depth direction within slot 15a and a inner layer and an outer layer might be taken by turns every six slots. moreover, the 2nd coil 32 -- wavelike so that may be taken a strand 30 in the slot depth direction within slot 15a and a inner layer and an outer layer may be taken by turns every six slots, to the 1st coil 31, it shifts 180 degrees, is reversed, an electrical angle is looped around, and it is constituted by the wave volume coil of 1 turn Similarly, the 3rd and 4th coils 33 and 34 are looped around wavelike so that a strand 30 may be taken by turns [ 4th by turns / 3rd ] in slot 15a every six slots, respectively. the 5th and 6th coils 35 and 36 -- respectively -- a wave volume is carried out so that may be taken a strand 30 in the slot depth direction within slot 15a and a inner layer and an outer layer may be taken by turns every six slots, and it is constituted by the wave volume coil of 1 turn And series-connection coil 161a which carried out the series connection of the 1st, the 3rd, and 5th coils 31, 33, and 35, and series-connection coil 161b which carried out the series connection of the 2nd, the 4th, and 6th coils 32, 34, and 36 are connected in parallel, and the stator winding group 161 is constituted. Since the stator winding 16 consists of only wave volume coils, while being able to make the height of a coil end low by this compared with the conventional technology in which the lap winding coil and the wave volume coil were made intermingled, the exposed-surface product of a coil end can be enlarged. And since the height of a coil end becomes low, a miniaturization can be attained. Moreover, since a wirewound-resistor value becomes small and heat loss becomes small, the calorific value in a stator winding 16 decreases, the leakage reactance of a coil end decreases further, and a high increase in power is attained. Moreover, since the exposed-surface product of a coil end becomes large, a stator winding 16 is cooled efficiently, the temperature rise of a stator winding 16 is stopped, and a high increase in power is attained.

[0042] Moreover, the stator winding group 161 of 3 turns can be formed from six coils constituted by the wave volume coil of 1 turn, respectively. That is, the stator winding group 161 of an odd number turn can be formed by looping around a pair of  $(2m+1)$  ( $m$  : natural number) wave volume coil group. That is, although the stator winding group 161 of each phase has not been conventionally constituted in an odd number turn when the stator winding consisted of two or more pairs of wave volume coil groups, the stator winding group 161 of each phase of an odd number turn is realized because divide a coil group two and it carries out parallel connection. Furthermore, since flakiness of a strand can be made small even if it reduces the number of turns, aggravation of the moldability of a strand can be suppressed. For example, in the stator which constituted the stator winding 16 from a stator winding group 161 of 4 turns, it becomes one cure to reduce the number of turns of a stator winding 161 by armature reaction, when the output in a high-speed rotation region is not enough. Although the stator winding group of 2 turns will be used supposing the stator winding group of an odd number turn is unproducible at this time, if the number of turns is lowered too much sharply, the output in a low-speed rotation region will not come out, and the new problem of \*\* will occur. Therefore, that the stator winding group of an odd number turn is producible means that the increase in an output in a high-speed rotation region is realizable, decrease of 1 turn carrying out the number of turns of each phase to the stator winding whose output in a high-speed rotation region is not enough by armature reaction, being able to cope with it, and suppressing the loss of power in a low-speed rotation region.

[0043] moreover -- since 1st series-connection coil 162a consists of the 1st, the 3rd, and 5th coils 31, 33, and 35 and 2nd series-connection coil 162b consists of the 2nd, the 4th, and 6th coils 32, 34, and 36 -- the [ the 1st and ] -- 2 series-connection coils 162a and 162b consist of coils of a inner layer, a middle lamella, and an outer layer,

respectively then, the time of a cooling wind ventilating a coil end -- the [ the 1st and ] -- it will be cooled equally and 2 series-connection coils 162a and 162b can stop the temperature rise of a stator winding

[0044] moreover -- since a strand 30 is a successive line -- a strand -- a conductor -- compared with the conventional technology using a segment, a welding part is cut down remarkably Then, while complicated welding operation can be mitigated and workability improves, generating with poor welding is also reduced remarkably and can realize the high yield. moreover, a conductor -- the case where the edges of a segment are joined -- a conductor -- since the open end side of a segment is held with a fixture and welding is performed, the coil and height by the side of junction will become high With the form 1 of this operation, since a strand 30 is a successive line, it consists of turn section 30a of a strand 30, welding in coil endo form \*\* becomes unnecessary, and a coil end can make the height of a coil end low.

[0045] Moreover, since the pair of a wave volume coil group is constituted from a coil assembly 39, the looping-around work of a stator winding is simplified and the assembly nature of a stator improves. Moreover, when increasing the number of turns, it can respond by including the coil assembly 39 in a stator core in piles at a multilayer. moreover, a U character-like conductor -- the case where a segment is used -- a conductor -- since it is necessary to insert a segment in a slot from the end side of a stator core -- a conductor -- a segment will move more than slot length within a slot On the other hand, since the coil assembly 39 will be inserted in a slot from the inner circumference side of a stator core, the coil assembly 39 does not move it more than the slot depth within a slot. Therefore, it is hard to generate damage on the insulating coat resulting from rubbing of a strand and a slot internal surface at the time of the inclusion to a stator core, and the outstanding insulation is secured.

[0046] Moreover, since the stator winding group 161 of each phase is connected using the metal terminal 50, the connection work of a coil is simplified. Moreover, the number of turns can constitute the stator winding which has two kinds of stator winding groups, three turns and 6 turns, from one coil group composition by changing the metal terminal 50. That is, in the metal terminal 50, separate two pieces 51a1 of connection, and 51a2 from a phase outgoing-line 51a, and it forms in one. Separate the piece 52a2 of connection from the neutral point outgoing line 52, and it forms in a phase outgoing-line 51a at one. Separate two pieces 51b1 of connection, and 51b2 from b phase outgoing-line 51b, and it forms in one. Separate the piece 52b2 of connection from the neutral point outgoing line 52, and it forms in b phase outgoing-line 51b at one. By separating two more pieces 51c1 of connection, and 51c2 from c phase outgoing-line 51c, forming in one, separating the piece 52c2 of connection from the neutral point outgoing line 52, and forming in c phase outgoing-line 51c at one The stator winding group of 6 turns to which the 1st or 6th coil 31-36 was connected in series is constituted.

[0047] moreover -- this stator winding 16 -- turn section 30a of each strand 30 -- a hoop direction -- and since estrange mutually in the direction of a path, and it becomes three trains, is tidily arranged by the hoop direction and a coil and Groups 16f and 16r are constituted, the extension height from the end face of the stator core 15 in a coil and Groups 16f and 16r becomes low Thereby, \*\*\*\* resulting from rotation of a rotator 7 can be reduced. Moreover, the leakage reactance of the coil of a coil end decreases and a power efficiency improves. moreover -- this stator winding 16 -- turn section 30a of each strand 30 -- a hoop direction -- and since estrange mutually in the direction of a path, and it becomes three trains, is tidily arranged by the hoop direction and a coil and Groups 16f and 16r are constituted, the draft resistance in a coil and Groups 16f and 16r becomes equal in a hoop direction Thereby, a coil and Groups 16f and 16r are uniformly cooled in a hoop direction, and the temperature rise of a stator winding 16 is stopped. Moreover, since a cooling wind is ventilated by a coil and Groups 16f and 16r by the fan 5 who fixed to the axis end of a rotator 7, the temperature rise of a stator winding 16 can be stopped effectively.

[0048] the [ moreover, / the 1st and ] -- the resistance on the manufacture produced among three coil assemblies 39 since 2 series-connection coils 162a and 162b consist of coils of a inner layer, a middle lamella, and an outer layer, respectively, and the error of an inductance -- the [ the 1st and ] -- it distributes equally to 2 series-connection coils 162a and 162b -- having -- the [ the 1st and ] -- the resistance between 2 series-connection coil 162a and 162b and the difference of an inductance are suppressed Since it is suppressed that a part of current which flowed 1st series-connection coil 162a, for example flows to 2nd series-connection coil 162b by this, the loss of power resulting from the circulating current which flows from 1st series-connection coil 162a to 2nd series-connection coil 162b is suppressed. Moreover, the stator winding group 161 is three-phase-circuit [ every ]-star-type-connected, 2 sets of three-phase-circuit line windings 160 are formed, turn section 30a which extends, respectively from 96 slots (to every \*\*\*\* enough the 2 numbers of slots) aligns at a hoop direction, and is arranged, and the three phase each line winding 160 is connected to the rectifier 12, respectively. It connects in parallel and the dc output of each rectifier 12 is compounded. And since the total of turn section 30a which each coil and Groups 16f and 16r arrange in three trains 96 turn sections 30a which aligned at the hoop direction and was arranged in the direction of a path, are constituted, and constitutes each coil and Groups 16f and 16r becomes 288 pieces, cooling nature becomes very high, the temperature rise of a stator winding is stopped, and a high increase in power is attained. Moreover, since the current from which 2 sets of

30-degree phases shifted occurs, the temperature distribution in a coil and a group will also become uniform compared with the conventional thing, the temperature rise of a stator winding is stopped, and a high increase in power is attained. Furthermore, since it is rectified by 2 sets of rectifiers and loss per rectifier diode is halved to the former, the temperature of rectifier diode also becomes low and a high increase in power is attained further. Furthermore, although it is common knowledge that the higher-harmonic magnetomotive-force component which causes a magnetic noise of a generator by looping phase contrast around 2 sets of coils 30 degrees is cancellable, like the gestalt of this operation, by arranging turn section 30a in line in three trains in the direction of a path, the rigidity of a coil end is raised and it is effective in reducing a magnetic noise further.

[0049] although continuation copper wire shall be used as a strand with the gestalt 1 of the gestalt 2. above-mentioned implementation of operation -- the gestalt 2 of this operation -- as a strand -- the conductor of the letter of the abbreviation for U characters -- the segment shall be used The perspective diagram explaining the array of the strand which constitutes the stator winding applied to the AC generator for vehicles which drawing 10 requires for the gestalt 2 of implementation of this invention, and drawing 11 are the perspective diagrams showing the stator of the AC generator for vehicles concerning the gestalt 2 of implementation of this invention. In addition, lead wire etc. is omitted in drawing 11. The short length copper-wire material which has the cross section of the rectangle with which the insulating coat 49 was covered is used for a strand 40, and it is fabricated in the shape of [ which connected bay 40b of the couple as slot stowage grade by V character-like turn section 40a ] abbreviation for U characters. And three strands 40 are inserted at a time in slot 15a of each class left 6 slot (1 pole pitch) from the end side of the shaft orientations of a stator core 15, and the open end section 40c side which extended to the other end side of the shaft orientations of a stator core 15 is bent in the shape of an outside aperture. At this time, it sets in slot 15a of each class. one strand 40 The 1st street in slot 15a of one, It is inserted in the 2nd street in other slot 15a. other one strand 40 The 3rd street in slot 15a of one, It is inserted in the 4th street in other slot 15a, and one more strand 40 is inserted in the 5th street [ 6th ] in other slot 15a in slot 15a of one. And six bay 40b of a strand 40 is arranged by the single tier about the direction of a path in each slot 15a.

[0050] And it is joined to open end section 40c to which open end section 40c which extends from the 1st street of one slot 15a to the other end side of a stator core 15 extends from the 2nd street, slot 15a besides 6 slot remote, and the wave volume coil of two 1 turns is obtained. These wave volume coils are equivalent to the 1st coil 31 and the 2nd coil 32 in the gestalt 1 of the above-mentioned implementation. Moreover, it is joined to open end section 40c to which open end section 40c which extends from the 3rd street of one slot 15a extends from the 4th street of slot 15a besides 6 slot remote, and the wave volume coil of two 1 turns is obtained. These wave volume coils are equivalent to the 3rd coil 33 and the 4th coil 34 in the gestalt 1 of the above-mentioned implementation. Furthermore, it is joined to open end section 40c to which open end section 40c which extends from the 5th street of one slot 15a extends from the 6th street of slot 15a besides 6 slot remote, and the wave volume coil of two 1 turns is obtained. These wave volume coils are equivalent to the 5th coil 35 and the 6th coil 36 in the gestalt 1 of the above-mentioned implementation. Thereby, as shown in drawing 11, stator winding 16A which consists of a wave volume coil of 1 turn, respectively obtains stator 8A around which the stator core 15 was looped.

[0051] Subsequently, based on the connection method shown in drawing 4, it connects three wave volume coils of 1 turn at a time to a serial, respectively, the series-connection coil is connected in parallel, and the stator winding group of 3 turns is obtained.

[0052] Therefore, also in the gestalt 2 of this operation, the same effect as the gestalt 1 of the above-mentioned implementation is acquired. moreover, the gestalt 2 of this operation -- setting -- as a strand 40 -- the conductor of the letter of the abbreviation for U characters -- since the wave volume coil is constituted using a segment -- a conductor -- the kind of segment -- one kind -- \*\*\*\* -- three kinds of conductors -- productivity improves compared with the conventional technology using a segment Moreover, since the coil end which consists of turn section 40a is located in a line with one train in the direction of a path, while the height of a coil end becomes low compared with the conventional technology in which the coil and the section which consist of the turn sections 311a, 312a, and 313a have lapped with three layers, an exposed-surface product becomes large. Then, compared with the conventional technology, a miniaturization and a high increase in power are attained.

[0053] gestalt 3. of operation -- with the gestalt 3 of this operation, one copper successive line which has the circular cross section with which the insulating coat 49 was covered as a strand 45 is used This strand 45 is bent and formed in the plane pattern with which bay 45b as slot stowage grade connected by turn section 45a was arranged by six slot pitches (6P) as shown in drawing 12. and adjacent bay 45b -- turn section 45a -- width-of-face (of a strand 45 -- it is shifted by W) In addition, other composition is constituted like the gestalt 1 of the above-mentioned implementation.

[0054] Then, according to the gestalt 3 of this operation, since the strand 45 has the circular cross section, bending nature improves compared with the strand 30 which has the rectangular section. Thereby, fabrication of turn section

45a (a coil and section) becomes easy, and can produce the coil assembly 39 now easily. Moreover, in case the amputation stump of the 1st or 6th coil 31-36 is welded to each piece of connection of the metal terminal 50, the work which bends the amputation stump of the 1st or 6th coil 31-36, and carries out alignment to the piece of connection becomes easy, and welding operation nature improves. Moreover, with the gestalt 3 of this operation, although the corner interferes and it is easy to produce the injury on the insulating coat 49 in the forming cycle of the coil assembly 39, or the wearing process to the stator core 15 of the coil assembly 39 when the strand 30 which has the rectangular section is used, since the strand 45 has the circular cross section, generating of the injury on the insulating coat 49 resulting from interference of strands can be suppressed, and insulation can be raised.

[0055] in addition, the conductor which has a circular cross section for a strand 40 in the gestalt 2 of the above-mentioned implementation although the strand 30 shall be replaced with the copper successive line which has a circular cross section in the gestalt 1 of the above-mentioned implementation with the gestalt 3 of the above-mentioned implementation -- the same effect is acquired even if it replaces with a segment

[0056] gestalt 4. of operation -- with the gestalt 4 of this operation, as shown in drawing 13, the coil assembly 39 should make low gradually the shaft-orientations height of turn section 30a toward the method of the outside of the direction of a path, and shall be arranged by three trains in the direction of a path In addition, other composition is constituted like the gestalt 1 of the above-mentioned implementation.

[0057] With the gestalt 1 of the above-mentioned implementation, the coil assembly 39 makes equal the shaft-orientations height of turn section 30a, and is arranged by three trains in the direction of a path. Then, the resistance of the 1st or 6th coil 31-36 becomes almost equal, and becomes almost equal [ the calorific value in the 1st or 6th coil 31-36 ]. Moreover, the 1st or 6th coil 31-36 will be cooled, so that it is located more in a inner layer side in the style of cooling from a fan 5. Thereby, the temperature distribution to which temperature becomes high gradually toward the method of the outside of the direction of a path arise in a stator winding 16, and there is a problem of reducing the cooling nature of a stator winding 16 in it. Since it is arranged by three trains in the direction of a path so that the coil assembly 39 may become gradually low toward [ on the other hand ] the method of the outside of the direction of a path at the gestalt 4 of this operation about the shaft-orientations height of turn section 30a, the resistance of the 1st or 6th coil 31-36 becomes gradually small toward the method of the outside of the direction of a path, and the method of the inside of the direction of a path becomes large [ the calorific value of Then, a coil with larger calorific value will be cooled, the temperature distribution in the direction of a path of a stator winding 16 become uniform, and a stator winding 16 will be cooled efficiently.

[0058] gestalt 5. of operation -- with the gestalt 5 of this operation, as shown in drawing 14, the strand 40 should make low gradually the shaft-orientations height of the joint of turn section 30a and open end section 40c toward the method of the outside of the direction of a path, and shall be arranged by three trains in the direction of a path In addition, other composition is constituted like the gestalt 2 of the above-mentioned implementation. Also in the gestalt 5 of this operation, since it is arranged by three trains in the direction of a path so that the joint of turn section 30a of a strand 40 and open end section 40c may become low gradually toward the method of the outside of the direction of a path about the shaft-orientations height, the same effect as the gestalt 4 of the above-mentioned implementation is acquired.

[0059] gestalt 6. of operation -- with the gestalt 6 of this operation, as shown in drawing 15, the insulating resin 38 shall be arranged between the crownings of the coil assembly 39 arranged by three trains in the direction of a path In addition, other composition is constituted like the gestalt 1 of the above-mentioned implementation.

[0060] According to the gestalt 6 of this operation, 2nd series-connection coil 162b which consisted of the 1st series-connection coil 162a which consisted of the 1st, the 3rd, and 5th coils 31, 33, and 35, the 2nd, the 4th, and 6th coils 32, 34, and 36 touches through the insulating resin 38. the [ the 1st and ] -- the heat generated with 2 series-connection coils 162a and 162b transmits mutually through the insulating resin 38 -- having -- the [ the 1st and ] -- the temperature of 2 series-connection coils 162a and 162b becomes almost equal Thereby, the coil of a stator winding and the temperature distribution of Groups 16f and 16r are equalized. Moreover, since the insulating resin 38 is arranged in the crowning of a coil and Groups 16f and 16r, aggravation of the cooling nature which the path of the cooling style which circulates in the direction of a path is secured, and depends the inside of a coil and 16f of groups, and 16r in the style of cooling is suppressed.

[0061] the conductor of the letter of the gestalt 7. abbreviation for U characters which has the circular cross section with which the insulating coat 49 was covered as the gestalt 7 of this operation is shown in drawing 16 of operation -- segments 51, 52, and 53 are used as a strand and a conductor -- segments 51, 52, and 53 are inserted in the slot of 6 slot remote each class from the end side of the shaft orientations of a stator core, join the edges which extend to the other end side of the shaft orientations of a stator core by welding etc., and are formed in the coil which carries out the surroundings of a stator core 4 round and the conductor which extends from the 3rd street of one slot to the other end side of the shaft orientations of a stator core -- the conductor to which edge 53c of a segment 53 extends from the 4th

street of a slot besides 6 slot remote -- it is joined to edge 53c of a segment 53, and two coils 61 and 63 of the wave winding of 1 turn are formed per slot It is joined to edge 52c of a segment 52. moreover, the conductor which extends from the 1st street of one slot -- the conductor to which edge 51c of a segment 51 extends from the 2nd street, a slot besides 6 slot remote, -- the conductor which extends from the 5th street of one more slot -- the conductor to which edge 52c of a segment 52 extends from the 6th street of a slot besides 6 slot remote -- it is joined to edge 51c of a segment 51, and two coils 62 and 64 of the lap winding of 2 turns are formed per slot

[0062] here -- the inside of each slot -- a conductor -- six bays 51a, 52a, and 53a as each slot stowage of segments 51, 52, and 53 are arranged by the single tier about the direction of a path of a stator core moreover, it is shown in the end side of the shaft orientations of a stator core at drawing 17 -- as -- a conductor -- turn section 52b of a segment 52 -- a conductor -- turn section 53b of a segment 53 -- surrounding -- a conductor -- turn section 51b of a segment 51 -- a conductor -- turn section 52b of a segment 52 is surrounded And the turn sections 51b, 52b, and 53b become three layers in layers to shaft orientations, are tidily arranged by the hoop direction, and constitute the coil and the group. on the other hand -- the other end side of the shaft orientations of a stator core -- setting -- a conductor -- the joint of the edges 51c and 52c of a segment 52, the joint of Edges 53c and 53c, and the joint of Edges 52c and 51c are arranged by one train in the direction of a path, as shown in drawing 17 And the joint of Edges 51c, 52c, and 53c becomes three trains, is tidily arranged by the hoop direction, and constitutes the coil and the group.

[0063] And as shown in drawing 18 , 3 turn coil 163a is constituted, the coil 63 of a wave winding and the coil 64 of a lap winding are connected in series, 3 turn coil 163b is constituted, 3 turn coils 163a and 163b are connected [ the coil 61 of a wave volume and the coil 62 of a lap winding are connected in series, ] in parallel, and the stator winding group 161 of each phase of 3 turns is constituted. Thus, three-phase-circuit [ every ] alternating current connection of the constituted stator winding group 161 is carried out, 2 sets of three-phase-circuit line windings 160 are formed, and the three phase each line winding 160 is connected to the rectifier 12, respectively. And it connects in parallel and the dc output of each rectifier 12 is compounded.

[0064] the conductor which has a circular cross section as a strand in the form 7 of this operation -- since segments 51, 52, and 53 are used, bending nature improves compared with the strand which has the rectangular section fabrication of the turn sections 51b, 52b, and 53b (a coil and section) is easy by this -- becoming -- a conductor -- segments 51, 52, and 53 can be easily produced now Bending by the side of the edge of segments 51, 52, and 53 becomes easy. moreover, a conductor -- In case Edges 51c and 52c and 53c are welded, further Edge 51c, the time of welding 52c and 53c to each piece of connection of the metal terminal 50 -- a conductor -- the work which bends the edge side of segments 51, 52, and 53, and carries out alignment of the edges 51c, 52c, and 53c becomes easy, and welding operation nature improves Moreover, with the form 7 of this operation, although the corner interferes and it is easy to produce damage on the insulating coat 49 when the strand which has the rectangular section is used, since the strand has the circular cross section, generating of damage on the insulating coat 49 resulting from interference of strands can be suppressed, and insulation can be raised. Moreover, since it is formed so that the turn sections 51b, 52b, and 53b which constitute a coil and the section may be located in a line with shaft orientations in layers at three layers, and the turn sections 51b, 52b, and 53b of three layers are arranged by the hoop direction at abbreviation homogeneity, the draft resistance in a coil and a group becomes equal in a hoop direction. Thereby, a coil and a group are uniformly cooled in a hoop direction, and the temperature rise of a stator winding is stopped.

[0065] furthermore -- the form 7 of this operation -- a conductor -- bay 51a of segments 51, 52, and 53 -- 52a and six 53 a are arranged by one train in the slot depth direction at each of a slot. And edge 51c of the layer from which the slot depth direction of 6 slot remote each slot pair in the outside of a slot differs, 52c and 53c are joined, two 3 turn coils 163a and 163b are formed, 3 turn coils 163a and 163b are connected in parallel, and the stator winding group 161 of each phase is constituted. And three-phase-circuit [ every ] alternating current connection (star type connection) of the stator winding group 161 is carried out, and 2 sets of three-phase-circuit line windings 160 are constituted, and after a rectifier 12 rectifies independently, respectively, the ac output of 2 sets of three-phase-circuit line windings 160 is compounded, and it is made to output it. Then, the turn sections 51b, 52b, and 53b which extend, respectively from 96 slots (to every \*\*\*\* enough the 2 numbers of slots) become three layers in layers to shaft orientations at the end side of the shaft orientations of a stator core, it is tidily arranged by the hoop direction, and the coil and the group are constituted. the conductor which extends from 96 slots to the other end side of the shaft orientations of a stator core on the other hand, respectively -- the joint of the edges 51c, 52c, and 53c of a segment 52 is tidily arranged by the hoop direction together with three trains in the direction of a path, and constitutes the coil and the group That is, since the total of the joint of the turn sections 51b, 52b, and 53b which constitute each coil and a group, and Edges 51c, 52c, and 53c becomes 288 pieces, respectively, cooling nature becomes very high, the temperature rise of a stator winding is stopped, and a high increase in power is attained. Moreover, since the current from which 2 sets of 30-degree phases shifted occurs, the temperature distribution in a coil and a group will also become uniform compared with the

conventional thing, the temperature rise of a stator winding is stopped, and a high increase in power is attained. Furthermore, since it is rectified by 2 sets of rectifiers and loss per rectifier diode is halved to the former, the temperature of rectifier diode also becomes low and a high increase in power is attained further. Furthermore, although it is common knowledge that the higher-harmonic magnetomotive-force component which causes a magnetic noise of a generator by looping phase contrast around 2 sets of coils 30 degrees is cancellable Like the form of this operation by aligning at three layers and arranging the turn sections 51b, 52b, and 53b Moreover, by arranging the joint of Edges 51c, 52c, and 53c in line in three trains in the direction of a path, the rigidity of a coil end is raised and it is effective in reducing a magnetic noise further.

[0066] Although parallel connection of the coil of a lap winding and the coil of a wave volume shall be carried out and the coil of each phase of a stator winding shall be formed with the gestalt 7 of the above-mentioned implementation here, the composition of a coil is not limited to this.

[0067] In addition, although the gestalt of each above-mentioned implementation explains as what uses copper material for a strand, a strand may not be limited to copper material and aluminum material is sufficient as it. Moreover, although the gestalt of each above-mentioned implementation explains as what is applied to the stator winding of the AC generator for vehicles, even if it applies this invention to other AC generators and motors, it does the same effect so. Moreover, although the gestalt of each above-mentioned implementation explains as what is applied to the stator which works as an armature, it is needless to say that this invention is applicable to the rotator which works as an armature.

[0068]

[Effect of the Invention] Since this invention is constituted as mentioned above, it does so an effect which is indicated below.

[0069] In the rotation electrical machinery equipped with the armature which has the armature core by which two or more slots prolonged in shaft orientations were prepared in the hoop direction according to this invention, and the armature winding around which the above-mentioned slot of this armature core was looped The 1st wave volume coil group which comes to arrange the above-mentioned armature winding by the number as the above-mentioned number of predetermined slots with the 1st coil of 1 turn constituted by looping around wavelike so that might be taken a strand in the slot depth direction within a slot and a inner layer and an outer layer might be taken by turns for every number of predetermined slots same at one slot pitch, For every above-mentioned number of predetermined slots so that may be taken the above-mentioned strand in the slot depth direction within the above-mentioned slot and a inner layer and an outer layer may be taken by turns wavelike And the 2nd wave volume coil group which comes to arrange the 2nd coil of 1 turn constituted by looping around so that it might shift 180 degrees and might be reversed by the electrical angle to the 1st coil of the above by one slot pitch by the same number as the above-mentioned number of predetermined slots The slot stowage grade of the 1st coil of the above, and the slot stowage grade of the 2nd coil of the above in the slot depth direction in each above-mentioned slot by turns n pair ( $n$  : natural number) arrangement is carried out, and it is constituted so that it may rank with one train. and each phase of the above-mentioned armature winding The series-connection coil of two  $n$  turns constituted by connecting at a time to a serial  $n$  the  $2n$  above 1st and the 2nd coil around which the same slot group which consists of slots for every above-mentioned number of predetermined slots is looped is connected in parallel, and it is constituted. Since the height of a coil end becomes low, and a wirewound-resistor value becomes small by this and the exposure surface area of a coil end becomes large, the rotation electrical machinery which can realize a miniaturization and a high increase in power is obtained. Moreover, parallel winding can be constituted, without enlarging flakiness of the cross section of a strand extremely.

[0070] Moreover, the 1st series-connection coil of  $n$  turn constituted by the two above-mentioned series-connection coils connecting in series the 1st  $n$  coils of the above around which the same above-mentioned slot group is looped, Since it consists of 2nd series-connection coils of  $n$  turn constituted by connecting in series the 2nd  $n$  coils of the above around which the same above-mentioned slot group is looped The 1st series-connection coil and the 2nd series-connection coil come to be cooled with sufficient balance, and the cooling nature of a stator winding can be raised.

[0071] Moreover, since Above  $n$  is  $2m+1$  ( $m$  : natural number), the fall of the output in a low-speed rotation region can be suppressed, armature reaction can be lessened, and the output in a high-speed rotation region can be raised.

[0072] moreover, the above-mentioned strand -- the conductor of the letter of the abbreviation for U characters -- a segment -- it is -- the above of plurality respectively -- a conductor -- the conductor from which a configuration differs while the height of a coil end becomes low, and the exposed-surface product of a coil end becomes large and a high increase in power and a miniaturization are attained, since the open ends of a segment are joined and it is constituted by the wave volume coil of 1 turn -- it is not necessary to prepare two or more segments,

[0073] moreover, the above-mentioned strand -- continuation -- a conductor -- a line -- it is -- the above 1st and the 2nd coil -- respectively -- the above-mentioned continuation of one -- a conductor -- since lines are consisted of by the

wave volume coil of 1 turn, a junction part is cut down remarkably, productivity and the yield can be raised, and the height of a coil end becomes low, and the exposed-surface product of a coil end becomes large, and a high increase in power and a miniaturization are attained

[0074] the [ moreover, / the above 1st and ] -- since each set of 2 wave volume coil group consists of coil assemblies which gathered two or more above 1st and the 2nd coil, respectively, while injury generating of the insulating coat at the time of the inclusion to an armature core is suppressed and insulation is secured, it can respond also to the increase in the number of turns easily

[0075] Moreover, since the above-mentioned strand is a conductor which has an approximate circle form cross section, while the moldability of a strand becomes easy, injury generating of the insulating coat resulting from interference of strands is suppressed.

[0076] Moreover, since the two above-mentioned series-connection coils which constitute each phase of the above-mentioned armature winding are connected through the metal terminal, connection work becomes easy.

[0077] Moreover, since it has the rotator which forms NS pole along with the rotation hoop direction which is the stator core of the shape of a cylinder which consists of a layer-built iron core, and was arranged in the interior of the above-mentioned stator core by the same axle, and the fan who fixed at the shaft-orientations edge of the above-mentioned rotator and was made for a cooling wind to be ventilated by the coil and the section of the above-mentioned armature winding by rotation of the above-mentioned fan, the cooling nature of the above-mentioned armature core of a stator winding improves.

[0078] Moreover, since the shaft-orientations extension height from the above-mentioned stator core is low gradually toward the method of the outside of the direction of a path, as for n pairs of the above-mentioned 1st wave volume coil group and the above-mentioned 2nd wave volume coil group, the temperature distribution of the direction of a path of a stator winding are equalized.

[0079] Moreover, it sets for the rotation electrical machinery equipped with the armature which has the armature core by which two or more slots prolonged in shaft orientations were prepared in the hoop direction, and the armature winding around which the above-mentioned slot of this armature core was looped. The above-mentioned slot has been equivalent to every \*\*\* enough, and is formed in the above-mentioned armature core two pieces. the above-mentioned armature winding It consists of 2 sets of line windings which come to connect the coil of each phase a star type. the coil of each above-mentioned phase  $2n$  ( $n$  : natural number) array of the strand is carried out in the slot depth direction at each of the above-mentioned slot. And connect in parallel 2 sets of  $n$  turn coils looped around and constituted so that the layers from which the slot depth direction of number remote of predetermined slots each slot pair in the outside of a slot differs might be connected, and it is constituted. Furthermore, since it is constituted so that it may be compounded and outputted after the ac output of the 2 above-mentioned sets of line windings is rectified independently by the 1st and 2nd rectifiers, respectively, the rotation electrical machinery of high power is obtained.

[0080] Moreover, since it is formed so that the coil and the section of the above-mentioned strand which connect the layers of the above-mentioned armature core from which the slot depth direction of number remote of predetermined slots each slot pair differs in an end side at least may be located in a line with  $n$  train in the direction of a path, and the above-mentioned coil of  $n$  train and the shaft-orientations height of the section are low gradually toward the method of the outside of the direction of a path, the temperature distribution of the direction of a path of an armature winding

[0081] Moreover, it is formed so that the coil and the section of the above-mentioned strand which connect the layers of the above-mentioned armature core from which the slot depth direction of number remote of predetermined slots each slot pair differs in an end side at least may be located in a line with  $n$  train in the direction of a path. And since the above-mentioned coil and the section of  $n$  train are arranged by the hoop direction at abbreviation homogeneity, the draft resistance in a coil and a group becomes equal in a hoop direction, a coil and a group are uniformly cooled in a hoop direction, and the temperature rise of an armature winding is stopped.

[0082] Moreover, it is formed so that the coil and the section of the above-mentioned strand which connect the layers of the above-mentioned armature core from which the slot depth direction of number remote of predetermined slots each slot pair differs in an end side at least may be located in a line with shaft orientations in layers at  $n$  layers. And since the above-mentioned coil of  $n$  layers and the section are arranged by the hoop direction at abbreviation homogeneity, the draft resistance in a coil and a group becomes equal in a hoop direction, a coil and a group are uniformly cooled in a hoop direction, and the temperature rise of an armature winding is stopped.

[0083] moreover, the above-mentioned strand -- the conductor of the letter of the abbreviation for U characters -- since it consists of segments, reduction of a wirewound-resistor value, alignment-izing of a coil end, and densification are attained

[0084] moreover, the above-mentioned strand -- continuation -- a conductor -- since it consists of lines, a junction part is cut down remarkably and productivity and the yield can be raised

[0085] Moreover, since the insulating resin is made to intervene among 2 sets of the above-mentioned armature core which constitutes the coil of each above-mentioned phase in an end side at least of above-mentioned n turn coils, the temperature gradient between n turn coils decreases, and the temperature distribution of an armature winding are equalized.

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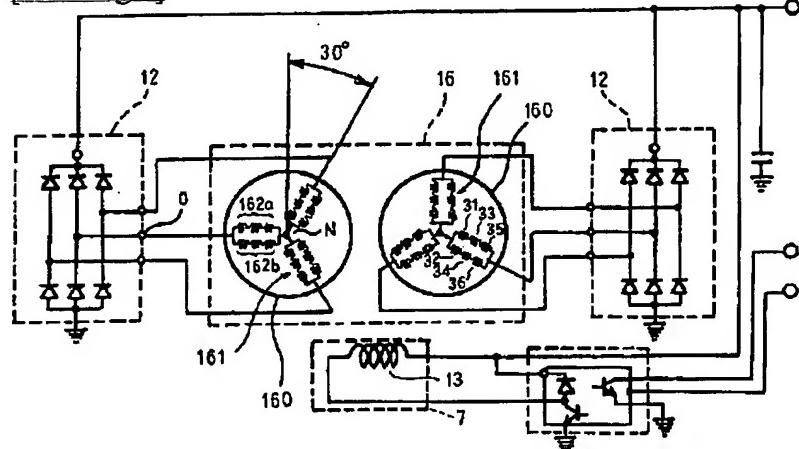
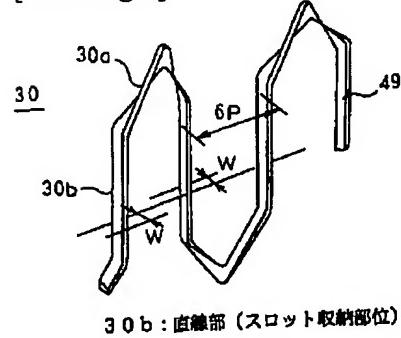
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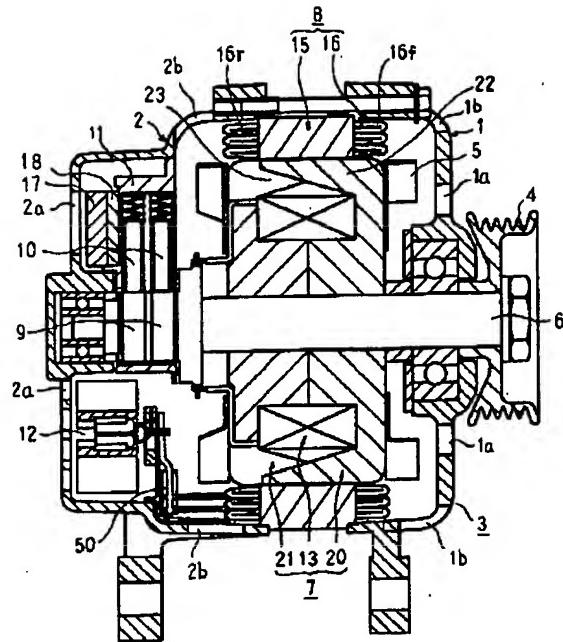
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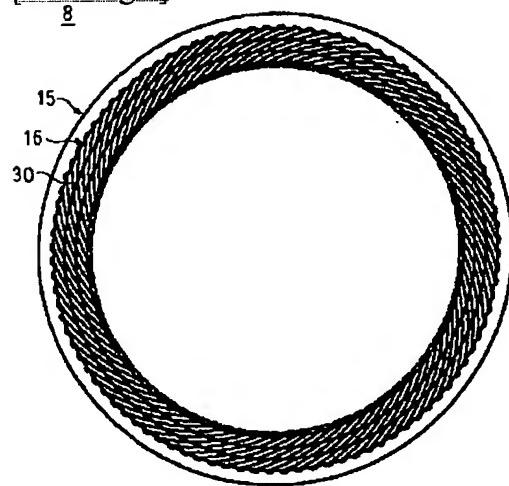
## DRAWINGS

[Drawing 5][Drawing 7][Drawing 1]



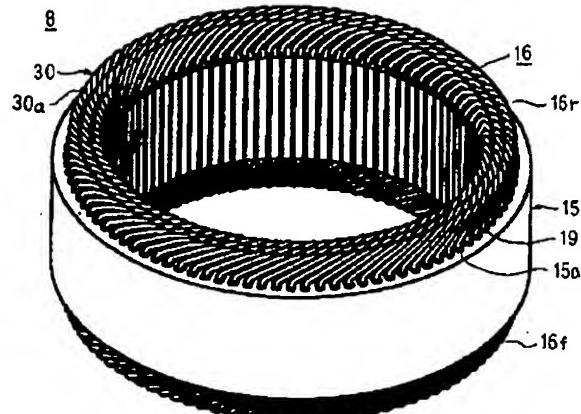
5 : ファン  
7 : 回転子  
8 : 固定子 (電機子)  
15 : 固定子鉄心 (電機子鉄心)  
16 : 固定子巻線 (電機子巻線)  
16r : 固定子巻線 (電機子巻線)  
16t : 固定子巻線 (電機子巻線)  
20 : 金属製ターミナル  
30 : 素線

[Drawing 2]



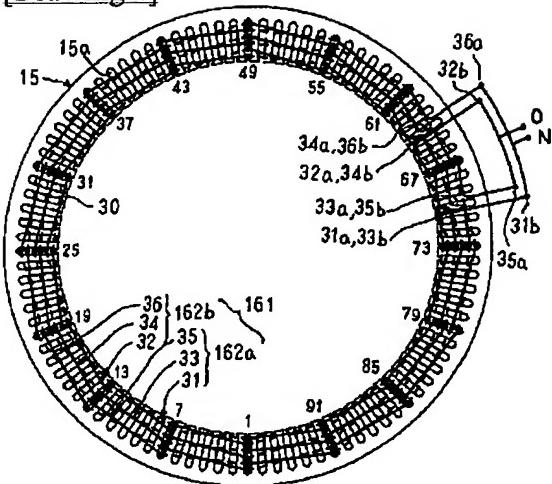
30 : 素線

[Drawing 3]



### 15a：スロット

### [Drawing 4]



31 : 第1卷標

35：第5卷總

32 : 第2卷總

36 : 第6卷總

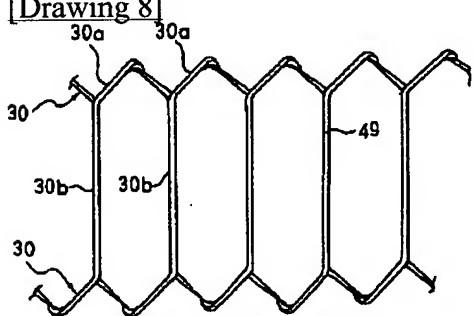
33 : 第3卷總

1628 ; 第1直列接続岩線

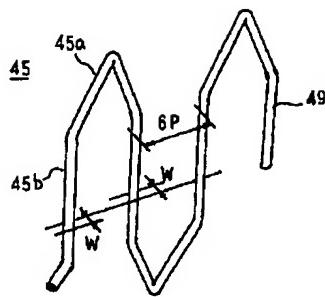
34 · 第4卷總

1.6.2.b：第2直列接続端子

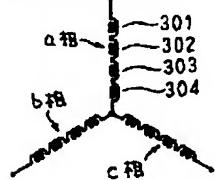
### [Drawing 8]



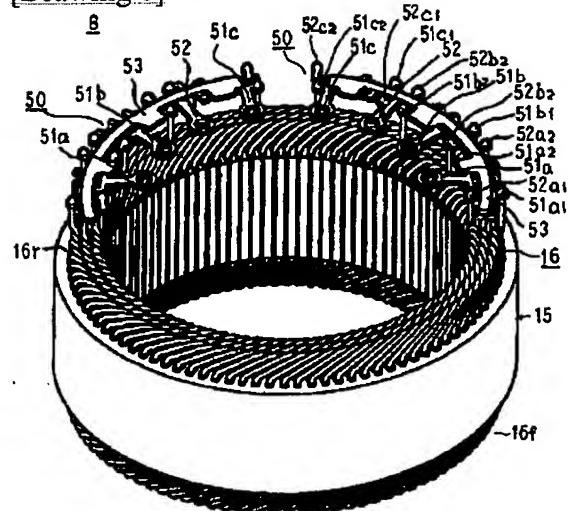
[Drawing 12]



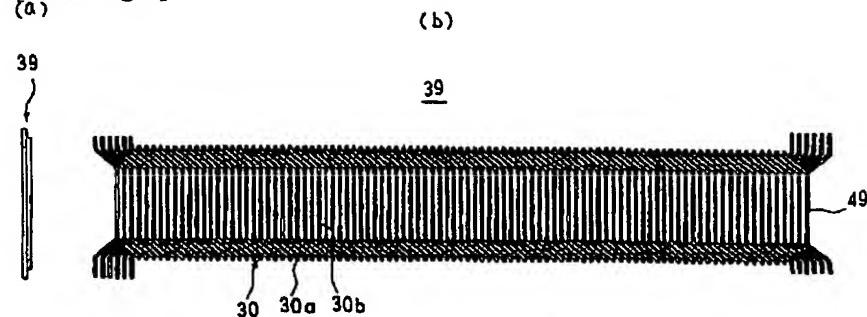
[Drawing 20]



[Drawing 6]

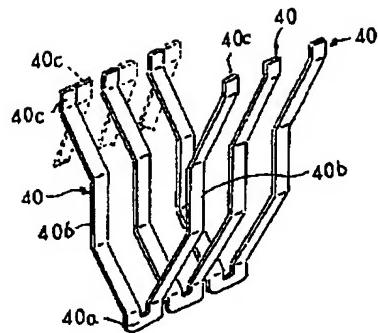


[Drawing 9]



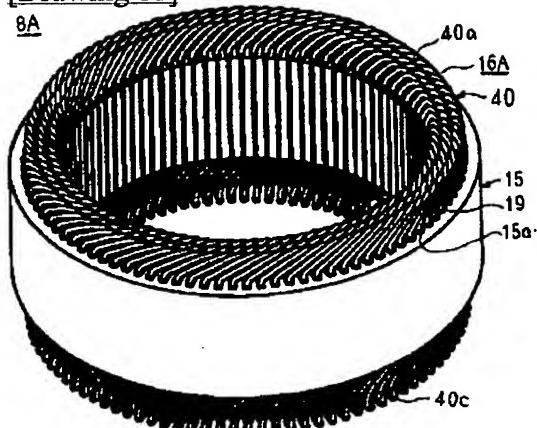
39 : 卷線アッセンブリ

[Drawing 10]



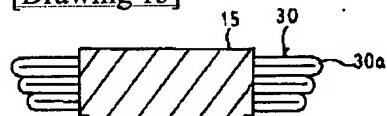
40 : 線  
40 b : 直線部（スロット収納部位）

[Drawing 11]

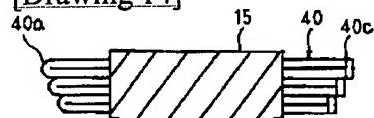


8A : 固定子（電機子）  
16A : 固定子巻線（電機子巻線）

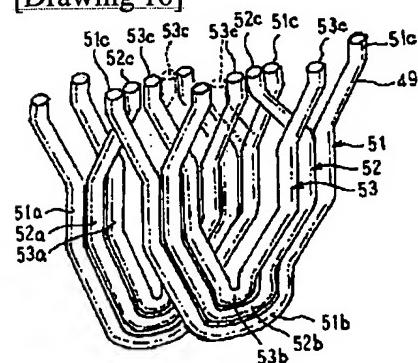
[Drawing 13]



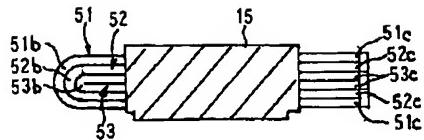
[Drawing 14]



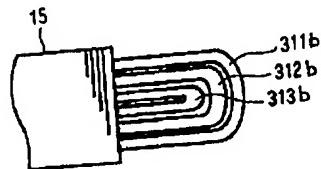
[Drawing 16]



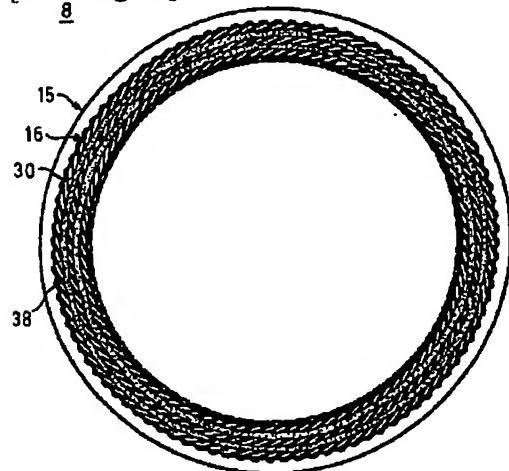
[Drawing 17]



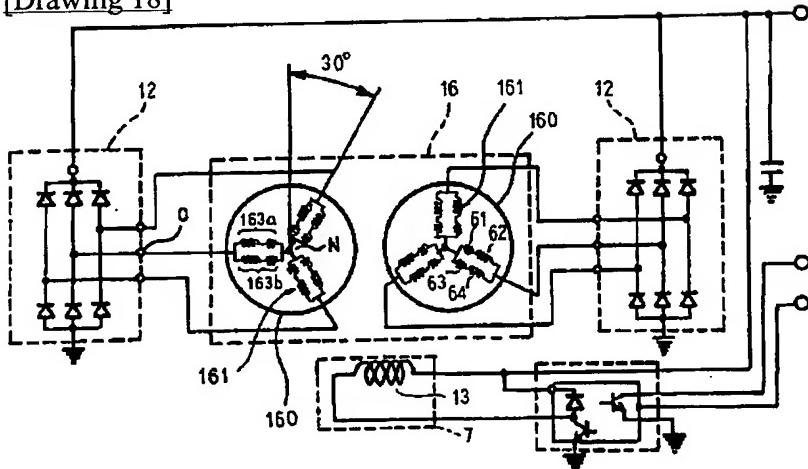
[Drawing 22]



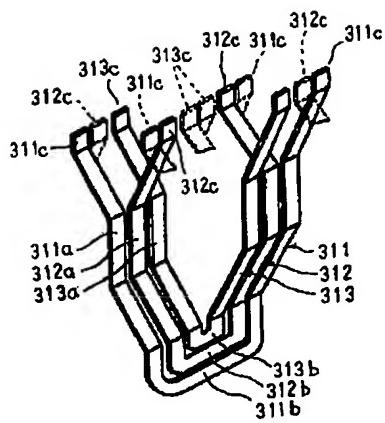
[Drawing 15]



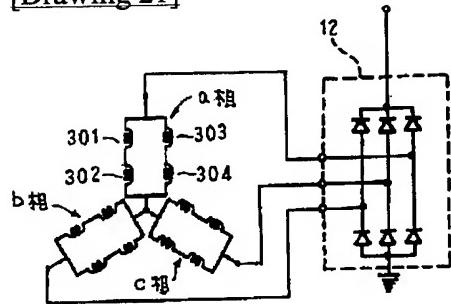
[Drawing 18]



[Drawing 19]



[Drawing 21]



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[Translation done.]

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## CORRECTION or AMENDMENT

[Official Gazette Type] Printing of amendment by the convention of 2 of Article 17 of patent law.

[Section partition] The 4th partition of the 7th section.

[Date of issue] April 11, Heisei 15 (2003. 4.11)

[Publication No.] JP,2002-58189,A (P2002-58189A)

[Date of Publication] February 22, Heisei 14 (2002. 2.22)

[\*\*\*\* format] Open patent official report 14-582.

[Filing Number] Application for patent 2000-243101 (P2000-243101)

[The 7th edition of International Patent Classification]

H02K 3/28  
3/04 .

3/24 .  
3/50 .

9/06 .  
19/22 .

## [FI]

H02K	3/28	N
3/04	E	.
J	.	.
3/24	J	.
3/50	A	.
Z	.	.
9/06	C	.
19/22		.

[Procedure revision]

[Filing Date] December 18, Heisei 14 (2002. 12.18)

[Procedure amendment 1]

[Document to be Amended] Specification.

[Item(s) to be Amended] Claim 11.

[Method of Amendment] Change.

[Proposed Amendment]

[Claim 11] In the rotation electrical machinery equipped with the armature which has the armature core by which two or more slots prolonged in shaft orientations were prepared in the hoop direction, and the armature winding around which the above-mentioned slot of this armature core was looped

The above-mentioned slot has been equivalent to every \*\*\*\* enough, and is formed in the above-mentioned armature core two pieces.

The above-mentioned armature winding consists of 2 sets of line windings which come to carry out alternating current connection of the coil of each phase.

The coil of each above-mentioned phase connects in parallel 2 sets of n turn coils looped around and constituted so that the layers from which  $2n$  ( $n$  : natural number) array of the strand is carried out in the slot depth direction at each of the

above-mentioned slot, and the slot depth direction of number remote of predetermined slots each slot pair in the outside of a slot differs might be connected, and it is constituted.

Furthermore, rotation electrical machinery characterized by being constituted so that it may be compounded and outputted, after the ac output of the 2 above-mentioned sets of line windings is rectified independently by the 1st and 2nd rectifiers, respectively.

[Procedure amendment 2]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0007.

[Method of Amendment] Change.

[Proposed Amendment]

[0007]

[Problem(s) to be Solved by the Invention] the stator winding of this conventional AC generator for vehicles -- three kinds of conductors large minor as mentioned above -- segments 311, 312, and 313 were inserted so that the slot stowages 311a, 312a, and 313a might be accumulated on the slot of 1 pole-pitch remote each class from the end side of a stator core, and the edges which extend to the other end side of a stator core were joined, and it was constituted. Then, while being unable to attain a miniaturization since the height of the coil end of the stator winding by the side of the end of a stator core 15 became high as shown in drawing 22, the wirewound-resistor value rose, heat loss became large, and the calorific value in a coil increased, and the leakage reactance of a coil end increased, and the technical problem that a high increase in power was not attained occurred. Moreover, since turn section 313b is covered by turn section 312b and turn section 312b is covered by turn section 311b, the exposure surface area of the coil end of the stator winding by the side of the end of a stator core 15 is reduced, and a stator winding is no longer cooled efficiently.

Consequently, the temperature of a stator winding became an elevated temperature and the technical problem that a high increase in power was not attained also occurred. Furthermore, it has been equivalent to every \*\*\*\* enough, and since the stator core which has the one number of slots is looped around 1 set of three-phase-circuit line windings and the output is rectified by 1 set of rectifiers, there are few numbers with which the turn section which extends from each slot aligns in a coil end at a hoop direction, and cooling nature is bad. Thereby, the temperature of a stator winding became an elevated temperature and the technical problem that a high increase in power was not attained occurred. Moreover, since only 1 set was equipped also with the rectifier, the loss per rectifier diode became large, it became an elevated temperature, and a high increase in power was difficult.

[Procedure amendment 3]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0019.

[Method of Amendment] Change.

[Proposed Amendment]

[0019] Moreover, it sets for the rotation electrical machinery equipped with the armature which has the armature core by which two or more slots prolonged in shaft orientations were prepared in the hoop direction, and the armature winding around which the above-mentioned slot of this armature core was looped. The above-mentioned slot has been equivalent to every \*\*\*\* enough, and is formed in the above-mentioned armature core two pieces. the above-mentioned armature winding It consists of 2 sets of line windings which come to carry out alternating current connection of the coil of each phase. the coil of each above-mentioned phase  $2n$  ( $n$  : natural number) array of the strand is carried out in the slot depth direction at each of the above-mentioned slot. And connect in parallel 2 sets of  $n$  turn coils looped around and constituted so that the layers from which the slot depth direction of number remote of predetermined slots each slot pair in the outside of a slot differs might be connected, and it is constituted. Furthermore, after the ac output of the 2 above-mentioned sets of line windings is rectified independently by the 1st and 2nd rectifiers, respectively, it is constituted so that it may be compounded and outputted.

[Procedure amendment 4]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0035.

[Method of Amendment] Change.

[Proposed Amendment]

[0035] And the amputation stumps 35a and 32b of the 5th which constitutes the stator winding group 161 of a phase, and 2nd coils 35 and 32 are welded to the piece 51a1 of connection, and 51a2, respectively, and the amputation stumps 31b and 36a of the 1st which constitutes the stator winding group 161 of a phase, and 6th coils 31 and 36 are welded to the piece 52a1 of connection, and 52a2, respectively. Moreover, the amputation stumps 35a and 32b of the 5th which constitutes the stator winding group 161 of b phase, and 2nd coils 35 and 32 are welded to the piece 51b1 of

connection, and 51b2, respectively, and the amputation stumps 31b and 36a of the 1st which constitutes the stator winding group 161 of b phase, and 6th coils 31 and 36 are welded to the piece 52b1 of connection, and 52b2, respectively. Furthermore, the amputation stumps 35a and 32b of the 5th which constitutes the stator winding group 161 of c phase, and 2nd coils 35 and 32 are welded to the piece 51c1 of connection, and 51c2, respectively, and the amputation stumps 31b and 36a of the 1st which constitutes the stator winding group 161 of c phase, and 6th coils 31 and 36 are welded to the piece 52c1 of connection, and 52c2, respectively.

[Procedure amendment 5]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0041.

[Method of Amendment] Change.

[Proposed Amendment]

[0041] Thus, according to the form 1 of this operation, a stator winding 16 is equipped with two three-phase-circuit line-winding groups 160, and the three phase each line winding 160 carries out alternating current connection of the three stator winding groups 161, and is constituted. Furthermore, each stator winding group 161 consists of the 1st or 6th coil 31-36. And the 1st coil 31 is looped around wavelike and constituted by the coil of 1 turn so that a strand 30 may be taken by turns [ 2nd by turns / 1st ] in slot 15a every six slots. That is, the 1st coil 31 is constituted by the wave volume coil of 1 turn by which the wave volume was carried out so that might be taken a strand 30 in the slot depth direction within slot 15a and a inner layer and an outer layer might be taken by turns every six slots. moreover, the 2nd coil 32 -- wavelike so that may be taken a strand 30 in the slot depth direction within slot 15a and a inner layer and an outer layer may be taken by turns every six slots, to the 1st coil 31, it shifts 180 degrees, is reversed, an electrical angle is looped around, and it is constituted by the wave volume coil of 1 turn Similarly, the 3rd and 4th coils 33 and 34 are looped around wavelike so that a strand 30 may be taken by turns [ 4th by turns / 3rd ] in slot 15a every six slots, respectively. the 5th and 6th coils 35 and 36 -- respectively -- a wave volume is carried out so that may be taken a strand 30 in the slot depth direction within slot 15a and a inner layer and an outer layer may be taken by turns every six slots, and it is constituted by the wave volume coil of 1 turn And series-connection coil 162a which carried out the series connection of the 1st, the 3rd, and 5th coils 31, 33, and 35, and series-connection coil 162b which carried out the series connection of the 2nd, the 4th, and 6th coils 32, 34, and 36 are connected in parallel, and the stator winding group 161 is constituted. Since the stator winding 16 consists of only wave volume coils, while being able to make the height of a coil end low by this compared with the conventional technology in which the lap winding coil and the wave volume coil were made intermingled, the exposed-surface product of a coil end can be enlarged. And since the height of a coil end becomes low, a miniaturization can be attained. Moreover, since a wirewound-resistor value becomes small and heat loss becomes small, the calorific value in a stator winding 16 decreases, the leakage reactance of a coil end decreases further, and a high increase in power is attained. Moreover, since the exposed-surface product of a coil end becomes large, a stator winding 16 is cooled efficiently, the temperature rise of a stator winding 16 is stopped, and a high increase in power is attained.

[Procedure amendment 6]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0058.

[Method of Amendment] Change.

[Proposed Amendment]

[0058] Form 5. of operation.

With the form 5 of this operation, as shown in drawing 14, the strand 40 should make low gradually the shaft-orientations height of the joint of turn section 40a and open end section 40c toward the method of the outside of the direction of a path, and shall be arranged by three trains in the direction of a path. In addition, other composition is constituted like the form 2 of the above-mentioned implementation. Also in the form 5 of this operation, since it is arranged by three trains in the direction of a path so that the joint of turn section 40a of a strand 40 and open end section 40c may become low gradually toward the method of the outside of the direction of a path about the shaft-orientations height, the same effect as the form 4 of the above-mentioned implementation is acquired.

[Procedure amendment 7]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0061.

[Method of Amendment] Change.

[Proposed Amendment]

[0061] Form 7. of operation.

the conductor of the letter of the abbreviation for U characters which has the circular cross section with which the

insulating coat 49 was covered as the form 7 of this operation is shown in drawing 16 -- segments 71, 72, and 73 are used as a strand and a conductor -- segments 71, 72, and 73 are inserted in the slot of 6 slot remote each class from the end side of the shaft orientations of a stator core, join the edges which extend to the other end side of the shaft orientations of a stator core by welding etc., and are formed in the coil which carries out the surroundings of a stator core 4 round and the conductor which extends from the 3rd street of one slot to the other end side of the shaft orientations of a stator core -- the conductor to which edge 73c of a segment 73 extends from the 4th street of a slot besides 6 slot remote -- it is joined to edge 73c of a segment 73, and two coils 61 and 63 of the wave winding of 1 turn are formed per slot It is joined to edge 72c of a segment 72. moreover, the conductor which extends from the 1st street of one slot -- the conductor to which edge 71c of a segment 71 extends from the 2nd street, a slot besides 6 slot remote, -- the conductor which extends from the 5th street of one more slot -- the conductor to which edge 72c of a segment 72 extends from the 6th street of a slot besides 6 slot remote -- it is joined to edge 71c of a segment 71, and two coils 62 and 64 of the lap winding of 2 turns are formed per slot

[Procedure amendment 8]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0062.

[Method of Amendment] Change.

[Proposed Amendment]

[0062] here -- the inside of each slot -- a conductor -- six bays 71a, 72a, and 73a as each slot stowage of segments 71, 72, and 73 are arranged by the single tier about the direction of a path of a stator core moreover, it is shown in the end side of the shaft orientations of a stator core at drawing 17 -- as -- a conductor -- turn section 72b of a segment 72 -- a conductor -- turn section 73b of a segment 73 -- surrounding -- a conductor -- turn section 71b of a segment 71 -- a conductor -- turn section 72b of a segment 72 is surrounded And the turn sections 71b, 72b, and 73b become three layers in layers to shaft orientations, are tidily arranged by the hoop direction, and constitute the coil and the group. on the other hand -- the other end side of the shaft orientations of a stator core -- setting -- a conductor -- the joint of the edges 71c and 72c of a segment 52, the joint of Edges 73c and 73c, and the joint of Edges 72c and 71c are arranged by one train in the direction of a path, as shown in drawing 17 And the joint of Edges 71c, 72c, and 73c becomes three trains, is tidily arranged by the hoop direction, and constitutes the coil and the group.

[Procedure amendment 9]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0064.

[Method of Amendment] Change.

[Proposed Amendment]

[0064] the conductor which has a circular cross section as a strand in the form 7 of this operation -- since segments 71, 72, and 73 are used, bending nature improves compared with the strand which has the rectangular section fabrication of the turn sections 71b, 72b, and 73b (a coil and section) is easy by this -- becoming -- a conductor -- segments 71, 72, and 73 can be easily produced now Bending by the side of the edge of segments 71, 72, and 73 becomes easy. moreover, a conductor -- In case Edges 71c and 72c and 73c are welded, further Edge 71c, the time of welding 72c and 73c to each piece of connection of the metal terminal 50 -- a conductor -- the work which bends the edge side of segments 71, 72, and 73, and carries out alignment of the edges 71c, 72c, and 73c becomes easy, and welding operation nature improves Moreover, with the gestalt 7 of this operation, although the corner interferes and it is easy to produce the injury on the insulating coat 49 when the strand which has the rectangular section is used, since the strand has the circular cross section, generating of the injury on the insulating coat 49 resulting from interference of strands can be suppressed, and insulation can be raised. Moreover, since it is formed so that the turn sections 71b, 72b, and 73b which constitute a coil and the section may be located in a line with shaft orientations in layers at three layers, and the turn sections 71b, 72b, and 73b of three layers are arranged by the hoop direction at abbreviation homogeneity, the draft resistance in a coil and a group becomes equal in a hoop direction. Thereby, a coil and a group are uniformly cooled in a hoop direction, and the temperature rise of a stator winding is stopped.

[Procedure amendment 10]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0065.

[Method of Amendment] Change.

[Proposed Amendment]

[0065] furthermore -- the gestalt 7 of this operation -- a conductor -- bay 71a of segments 71, 72, and 73 -- 72a and six 73 a are arranged by one train in the slot depth direction at each of a slot. And edge 71c of the layer from which the slot depth direction of 6 slot remote each slot pair in the outside of a slot differs, 72c and 73c are joined, two 3 turn coils

163a and 163b are formed, 3 turn coils 163a and 163b are connected in parallel, and the stator winding group 161 of each phase is constituted. And three-phase-circuit [ every ] alternating current connection (star type connection) of the stator winding group 161 is carried out, and 2 sets of three-phase-circuit line windings 160 are constituted, and after a rectifier 12 rectifies independently, respectively, the ac output of 2 sets of three-phase-circuit line windings 160 is compounded, and it is made to output it. Then, the turn sections 71b, 72b, and 73b which extend, respectively from 96 slots (to every \*\*\*\* enough the 2 numbers of slots) become three layers in layers to shaft orientations at the end side of the shaft orientations of a stator core, it is tidily arranged by the hoop direction, and the coil and the group are constituted. the conductor which extends from 96 slots to the other end side of the shaft orientations of a stator core on the other hand, respectively -- the joint of the edges 71c, 72c, and 73c of a segment 52 is tidily arranged by the hoop direction together with three trains in the direction of a path, and constitutes the coil and the group That is, since the total of the joint of the turn sections 71b, 72b, and 73b which constitute each coil and a group, and Edges 71c, 72c, and 73c becomes 288 pieces, respectively, cooling nature becomes very high, the temperature rise of a stator winding is stopped, and a high increase in power is attained. Moreover, since the current from which 2 sets of 30-degree phases shifted occurs, the temperature distribution in a coil and a group will also become uniform compared with the conventional thing, the temperature rise of a stator winding is stopped, and a high increase in power is attained. Furthermore, since it is rectified by 2 sets of rectifiers and loss per rectifier diode is halved to the former, the temperature of rectifier diode also becomes low and a high increase in power is attained further. Furthermore, although it is common knowledge that the higher-harmonic magnetomotive-force component which causes a magnetic noise of a generator by looping phase contrast around 2 sets of coils 30 degrees is cancellable Like the gestalt of this operation by aligning at three layers and arranging the turn sections 71b, 72b, and 73b Moreover, by arranging the joint of Edges 71c, 72c, and 73c in line in three trains in the direction of a path, the rigidity of a coil end is raised and it is effective in reducing a magnetic noise further.

[Procedure amendment 11]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0070.

[Method of Amendment] Change.

[Proposed Amendment]

[0070] Moreover, the 1st series-connection coil of n turn constituted by the two above-mentioned series-connection coils connecting in series the 1st n coils of the above around which the same above-mentioned slot group is looped, Since it consists of 2nd series-connection coils of n turn constituted by connecting in series the 2nd n coils of the above around which the same above-mentioned slot group is looped The 1st series-connection coil and the 2nd series-connection coil come to be cooled with sufficient balance, and the cooling nature of an armature winding can be raised.

[Procedure amendment 12]

[Document to be Amended] Specification.

[Item(s) to be Amended] 0079.

[Method of Amendment] Change.

[Proposed Amendment]

[0079] Moreover, it sets for the rotation electrical machinery equipped with the armature which has the armature core by which two or more slots prolonged in shaft orientations were prepared in the hoop direction, and the armature winding around which the above-mentioned slot of this armature core was looped. The above-mentioned slot has been equivalent to every \*\*\*\* enough, and is formed in the above-mentioned armature core two pieces. the above-mentioned armature winding It consists of 2 sets of line windings which come to carry out alternating current connection of the coil of each phase. the coil of each above-mentioned phase  $2n$  ( $n$  : natural number) array of the strand is carried out in the slot depth direction at each of the above-mentioned slot. And connect in parallel 2 sets of n turn coils looped around and constituted so that the layers from which the slot depth direction of number remote of predetermined slots each slot pair in the outside of a slot differs might be connected, and it is constituted. Furthermore, since it is constituted so that it may be compounded and outputted after the ac output of the 2 above-mentioned sets of line windings is rectified independently by the 1st and 2nd rectifiers, respectively, the rotation electrical machinery of high power is obtained.

[Procedure amendment 13]

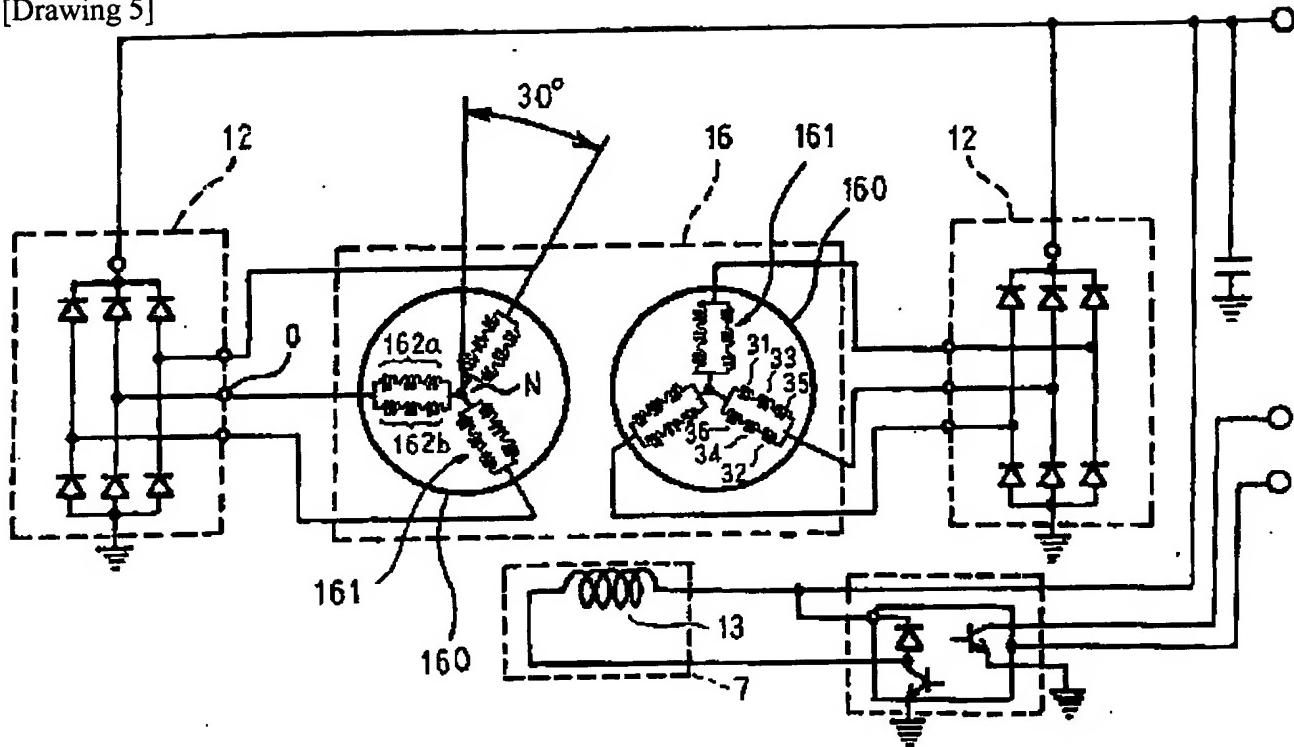
[Document to be Amended] DRAWINGS

[Item(s) to be Amended] Drawing 5.

[Method of Amendment] Change.

[Proposed Amendment]

[Drawing 5]



[Procedure amendment 14]

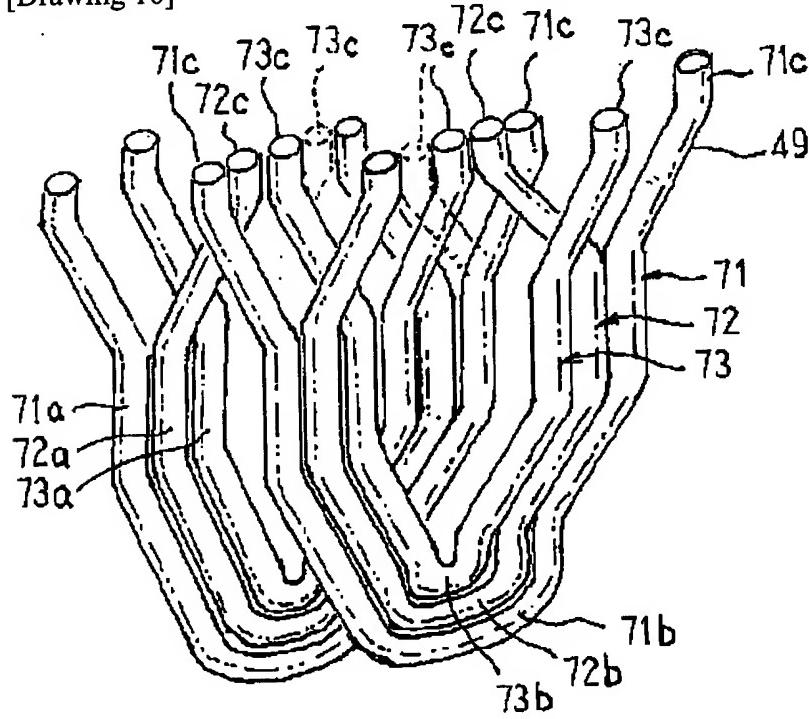
[Document to be Amended] DRAWINGS

[Item(s) to be Amended] Drawing 16.

[Method of Amendment] Change.

[Proposed Amendment]

[Drawing 16]



[Procedure amendment 15]

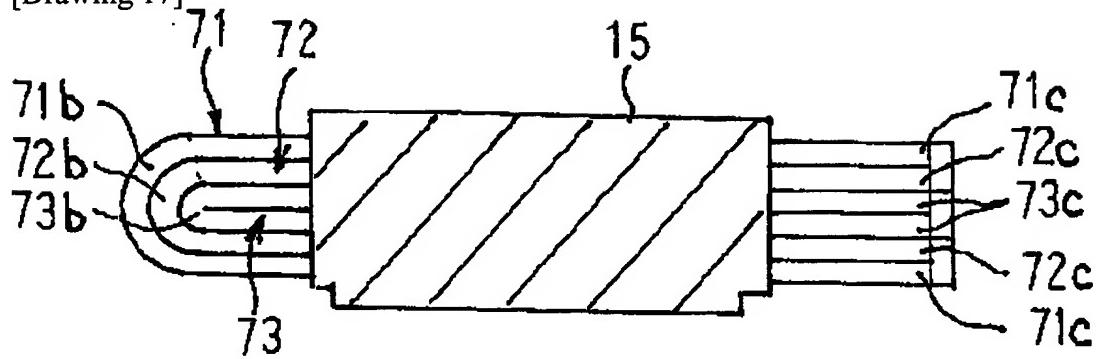
[Document to be Amended] DRAWINGS

[Item(s) to be Amended] Drawing 17.

[Method of Amendment] Change.

[Proposed Amendment]

[Drawing 17]



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[Translation done.]